INTERNATIONAL ASSOCIATION FOR TROPICAL AGRICULTURE

(L'ASSOCIATION SCIENTIFIQUE INTERNATIONALE D'AGRONOMIE COLONIALE ET TROPICALE)

Proceedings of the Third International Congress of Tropical Agriculture

HELD AT THE IMPERIAL INSTITUTE, LONDON, S.W., JUNE 23RD TO 30TH, 1914

Including Abstracts of the Papers, supplied by the Authors, and Reports of the Discussions

EDITED BY THE HONORARY SECRETARIES

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E. Molineux Ewart, Quilon, Travancore, India.
G. Farmer, New Malden, Surrey.
Boris de Fedtschenko, Principal Botanist, Imperial Botanic Garden of Peter the Great, St. Petersburg.
Dr. H. M. Fernando, Colombo, Ceylon.
John X. Fernando, Negombo, Ceylon.
The Hon. William Henry Figg (Messrs. Whittall & Co.), Colombo, Ceylon.
A. J. Findlay, Assistant Superintendent of Agriculture, Southern Provinces, Nigeria.
F. J. Fleming, Mankula, New Hebrides.
E. Gomez Flores, Directeur des Services agronomiques à Las Palmas, Iles Canaries.
A. J. Fontannaz (Wm. Porter & Co.), Liverpool.
Forestal Land, Timber and Railways Co., Ltd., London.
J. Fraser, Ceylon.
J. T. Furley, Provincial Commissioner, Gold Coast.
H. B. G. Garrett, Deputy Conservator of Forests, Siam.
E. P. Gaston (Messrs. Funk & Wagnalls, Ltd.), London.
H. Gauger, Colombo, Ceylon.
A. E. Gay, Warlingham, Surrey.

Prof. C. de Mello Geraldes, Professeur à la Section Coloniale de l'Institut Supérieur Agronomique de l'Université de Lisbonne.

L. Gerber, Zanzibar, East Africa.

R. Gill, Assistant Superintendent of Agriculture, Southern Provinces, Nigeria.

Gillespie Bros. & Co., London.

Dr. C. D. Girola, Museo Agricola de la Sociedad Rural Argentina, Buenos Aires, Argentine.

G. H. Golledge, Gikiyanakande Estate, Ceylon.

Dr. L. H. Gough, Chief, Entomological Section, Ministry of Agriculture, Egypt.

H. D. Graham, Jamaica, British West Indies.

E. E. Green (late Government Entomologist, Ceylon), Camberley, Surrey.

M. M. Hadow, Secretary, Assam Branch, Indian Tea Association, Dibrugarh, Assam.

Dr. C. J. J. van Hall, Chief of the Division for Plant Diseases, Department of Agriculture, Buitenzorg, Java.

A. Hallet, Brussels.

Sir D. M. Hamilton, Loughton, Essex.

W. S. Hamilton, Director of Agriculture and Industries, Punjab, India.

Hanson & Orth, London.

R. G. Harper, District Agricultural Officer, Uganda Protectorate.

Prof. J. B. Harrison, C.M.G., Director, Department of Science and Agriculture, British Guiana.

Harrisons & Crosfield, Ltd., London.

J. M. Harvard, Headlands, Rhodesia.

Hatton and Cookson, Ltd., Liverpool.

J. M. Hattrick (The Potash Syndicate), Sydney, Australia.

Hawaiian Sugar Planters' Association, Honolulu.

J. Hawke, Ratnapura, Ceylon.

T. G. Hayes (Rubber Growers' Association), London.

S. V. Henderson, Superintendent of Agriculture, Southern Provinces, Nigeria.

B. von Herff, Chicago.

H. P. Hewins, Director, Commercial Intelligence Branch, Central Economic Board, Sudan.

R. Hewison, Assistant Director of Agriculture, Sudan.

Dr. P. Hillmann, Secretary, German Section of the International Association for Tropical Agriculture, Berlin.

J. Holt, Liverpool.

J. Holt & Co., Liverpool.

Dr. D. Hooper (late Economic Botanist, Botanical Survey of India) Weston-super-Mare, England.

W. Hopkins, Director of Agriculture, Sierra Leone.

G. Hughes, London.

A. E. Humphries, Past President of the National Association of British and Irish Millers, Weybridge, England.

J. L. Hunt, President, Planters' Association of Fiji, Suva, Fiji.

T. Hunter, Curator, Agricultural Department, Gold Coast.

Fr. Hupfeld, Direktor der Deutschen Togogesellschaft, Berlin.

International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester.

Istituto Agricolo Coloniale Italiano, Florence.

A. H. Jackson, Pollibetta, Coorg, India.

Col. H. W. Jackson, C.B., Governor of Dongola Province, Sudan.

F. N. Jayewardene, London.

A. Jewell, Papua.

W. H. Johnson, Director of Agriculture, Southern Provinces, Nigeria.

J. E. Jones, Malindi, British East Africa.

J. F. Jowitt, London.

B. F. E. Keeling, Director of Physical Service, Survey Department, Egypt.

H. R. Kerr (Steel Bros. Co., Ltd.), Rangoon, India.

Keymer, Son & Company, London.

L. L. Kiddle, Bushey, England.

Kilburn, Brown & Co., London.

L. E. Knollys, Uganda.

C. H. Knowles, Superintendent of Agriculture, Fiji.

E. W. Knox (Colonial Sugar Refining Company, Ltd.), Sydney, New South Wales.

A. R. R. F. Koehn, London.

H. Koenig, Royal Institute for Ocean Traffic and International Commerce, University of Kiel, Germany.

L. Kopelowitz (British Humboldt Engineering Co., Ltd.), London.

T. Kusano, Kagoshima Imperial College of Agriculture and Forestry, Japan.

W. E. F. de Lacy, Deputy Recorder of Titles and Judge of the Land Registration Court, British East Africa.

C. Ladewig (Verband der Kamerun und Togo Pflanzungen), Berlin.

Harkishen Lal, Lahore, India.

P. H. Lamb, Director of Agriculture, Northern Provinces, Nigeria.

C. S. Lange, President, German East African Planters' Association, Berlin.

The Government of the Leeward Islands.

A. B. Leguia, London.

J. M. H. Lemmet, Directeur du Laboratoire d'Analyses, Hann, Dakar, Senegal.

Lever Bros., Ltd., Port Sunlight, Cheshire, England.

L. Lewton-Brain, Director of Agriculture, Federated Malay States.

Library of Congress, Washington, D.C., U.S.A.

E. Lierke (The Potash Syndicate), Berlin.

Sociedade de Geographia de Lisboa, Lisbon, Portugal.

London Chamber of Commerce.

Low Country Products Association of Ceylon, Colombo, Ceylon.

W. Lowrie, Director of Agriculture, South Australia.

R. N. Lyne, Director of Agriculture, Ceylon.

Sir Charles W. Macara, Bart., President, International Federation of Master Cotton Spinners' and Manufacturers' Associations, St. Annes-on-Sea, England.

J. S. J. McCall, Director of Agriculture, Nyasaland.

Col. Sir Henry E. McCallum, G.C.M.G. (formerly Governor of Newfoundland, Natal and Ceylon), Camberley, Surrey.

F. C. McClellan, Director of Agriculture, Zanzibar.

J. W. McConnel, Vice-Chairman of the Fine Cotton Spinners' and Doublers' Association, Ltd., Manchester.

H. F. Macmillan, Superintendent of Botanic Gardens, Ceylon.

J. McSwiney, Director of Land Records and Agriculture, Assam, India.

R. K. Magor, London.

Dr. N. J. Malahowski (Secretary, Cotton and Flax Committees of St. Petersburg), Russia.

Planters' Association of Malaya, Kuala Lumpur, Federated Malay States.

A. H. Malet, Sunthaik, Lower Burma, India.

Manchester Chamber of Commerce (African Section).

Dr. O. Manetti, Vice-direttore, Istituto Agricolo Coloniale, Florence.

Dr. H. H. Mann, Principal, Poona Agricultural College, India.
Institut Colonial de Marseille, France.
R. E. Massey, Economic Botanist, Sudan Government.
E. Mathon (Cie. française de l'Afrique occidentale), Marseille, France.
P. M. Matthew (Tebrau Rubber Estates, Ltd.), Edinburgh.
Mauritius Chamber of Agriculture.
J. M. de Mendonça, Lisbon.
A. C. Miles, Senior Curator, Botanic Gardens, Aburi, Gold Coast.
Miller Bros. (of Liverpool), Ltd.
G. Miller, Radlett, Herts.
R. B. Miller, Liverpool.
Millers, Ltd., London.
G. E. Millner (Nitrogen Fertilisers, Ltd.), London.
L. Misson, Directeur de l'Industrie animale de l'Etat de Saô Paulo, Brésil.
R. K. Mitter, Calcutta, India.
Companhia de Moçambique, London.
C. J. Monson, Advisor for Tobacco, Department of Agriculture, British East Africa.
Major T. C. Moore, I.M.S., Verwood, Dorset.
Prof. G. Morpurgo, Direttore, Museo commerciale, Trieste, Austria.
L. H. Moseley (Société an. des Huileries du Congo Belge) Liverpool.
J. P. Murphy, Berbice, British Guiana.
The Hon. G. Murray, Administrator of St. Vincent, British West Indies.
J. H. P. Murray, Lieutenant-Governor of Papua.
K. Nanjo (Mitsui & Co., Ltd.), London.
Nederlandsch-Indisch Landbouw Syndicaat, Soerabaya, Java.
G. H. Nevile, Lincoln, England.
New Egyptian Company, Ltd., London.
High Commissioner for New Zealand, London.
Dr. H. A. A. Nicholls, C.M.G., President, Agricultural and Commercial Society of Dominica, British West Indies.
L. P. Nielsen (Mornai Tea Estate), Assam, India.
The Niger Co., Ltd., London.
Nitrogen Fertilisers, Ltd., London.
Dr. E. A. Nobbs, Director of Agriculture, Southern Rhodesia.
Nyasaland Chamber of Agriculture and Commerce.

Companhia do Nyassa, London.

Sir Sydney Olivier, K.C.M.G., Permanent Secretary to the Board of Agriculture and Fisheries, London.

Dr. R. M. Ortiz, Cuban Minister in Paris.

P. Osterrieth, Vice-Président de l'Association des Planteurs de Caoutchouc, Antwerp.

T. Ottolander, President, Netherlands Indies Agricultural Syndicate, Banjoewangi, Java.

E. R. Owen, Assistant Superintendent of Agriculture, Southern Provinces, Nigeria.

N. Parachimonas, Cairo, Egypt.

W. H. Patterson, Government Entomologist, Gold Coast.

R. S. Pearson, Forest Economist, Forest Research Institute, Dehra Dun, India.

V. H. Pearson, Ipoh, Perak, Federated Malay States.

Viscount de Pedralva, Director of Agriculture, Portuguese West Africa, Angola.

J. Peiris (The Low-Country Products Association), Ceylon.

T. Petch, Government Botanist and Mycologist, Ceylon.

J. Peters (United Thomas Phosphate Works and the Chemical Works—late H. & E. Albert), London.

S. U. Pickering, F.R.S., Director of the Woburn Experimental Fruit Farm, England.

Dr. Carlos de Cerqueira Pinto, Para, Brazil.

E. Porritt (Messrs. Porritt and Riley), Liverpool.

J. H. Poyer, Secretary, Barbados General Agricultural Society.

Lt.-Col. Sir D. Prain, C.M.G., C.I.E., F.R.S., Director, Royal Botanic Gardens, Kew.

Sir John Pringle, K.C.M.G., Jamaica, British West Indies.

Rev. J. Proctor, London.

E. H. Pybus, British Solomon Islands.

Government of Queensland.

L. Radclyffe, London.

K. T. Rae, Assistant Superintendent of Agriculture, Northern Provinces, Nigeria.

Rai Bahadur Ganga Ram, Lahore, India.

L. J. S. Reid, Hombrom Bluff, Papua.

K. Remané (Singo Estates, Ltd.), Kampala, Uganda.

R. M. Richards, Mycologist, Malay Peninsula Agricultural Association, Province Wellesley, Straits Settlements.

T. S. Richmond (Egyptian Agricultural Co., Ltd.), Alexandria, Egypt.

H. N. Ridley, C.M.G., F.R.S. (late Director of Gardens, Straits Settlements), Kew, Surrey.

F. Crosbie Roles, Aspley Guise, Bedfordshire.

Dr. Roux, Directeur de l'Institut Pasteur; Membre de l'Académie des Sciences de Paris; Paris.

Lord Rowallan, Kilmarnock, Scotland.

Rowntree and Co., Ltd., York.

Royal Mail Steam Packet Co., London.

A. M. Russell (Messrs. H. B. W. Russell and Co., Ltd.), Liverpool.

P. Samson and Sons, Shwemyo, Burma, India.

W. N. Sands, Agricultural Superintendent, St. Vincent, British West Indies.

Dr. J. A. Pereira dos Santos, Wimbledon, England.

The Sarawak Rubber Estates, Limited, London.

C. Saunders, Senior Curator, Tamale, Gold Coast.

Dr. T. Schaller (Compagnie Alsacienne de Plantations au Brésil, Société an.), Strasbourg, Germany.

M. Schanz, Vice-President Cotton Commission, Kolonial-Wirtschaftliches Komitee, Chemnitz, Germany.

Dr. P. Schidrowitz, London.

Prof. Sir William Schlich, K.C.I.E., F.R.S. (late Inspector-General of Forests, India), Professor of Forestry, University of Oxford.

Arno Schmidt, Secretary, International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester.

W. Schultz, Chairman, London Division, German Colonial Society, London.

Dr. W. Schütze, London.

H. D. Scudamore, Department of Science and Agriculture, British Guiana.

T. L. Sefton (Sogeri Para Rubber Co., Ltd.), Papua.

R. Seth (Messrs. Robert Seth and Co.), Calcutta, India.

Government of Seychelles.

R. G. Shaw and Co., London.

Dr. T. Shiraki, Government Entomologist, Formosa.

F. Shuman, Philadelphia, U.S.A.

H. A. Sim, London.

S. Simpson, Director of Agriculture, Uganda.

W. Small, Government Botanist, Department of Agriculture, Uganda.

L. A. Smart, London.

H. Hamel Smith, Editor, *Tropical Life*, London.

C. M. Smyth, Belasoni, British East Africa.

F. Snowball, Melbourne, Australia.

Société générale des Etablissements Bergougnan, France.

W. Soper, Deputy Chairman, East African Section, London Chamber of Commerce.

H. Southern, Deputy Director of Agriculture, Punjab, India.

F. Spire, Provincial Commissioner, Eastern Province, Uganda.

J. Spirig, Zamboanga, Mindanao, Philippine Islands.

F. J. Stanes (T. Stanes and Co., Ltd.), Coimbatore, India.

E. J. Starey, Nairobi, British East Africa.

J. H. Starey, Bodenham, Herefordshire.

M. C. Steedman, London.

W. F. Stephens (The Mahé Syndicate), Mahé, Seychelles.

Stevenson and Howell, Ltd., London.

F. A. Stockdale, Director of Agriculture, Mauritius.

E. P. Storie, London.

Dr. W. M. Strong, Port Moresby, Papua.

G. M. Stuart, London.

Sutton and Sons, Reading, England.

J. Y. Svensen (The Solomon Islands Rubber Plantations, Ltd.), Ysabel Island, British Solomon Islands.

F. and A. Swanzy, Ltd., London.

W. Taylor, Liverpool.

Baron du Teil, Paris.

H. A. Tempany, Government Analytical and Agricultural Chemist, and Superintendent of Agriculture, Leeward Islands, British West Indies.

C. S. Thane (The Rangoon Para Rubber Estates, Ltd.), Twante, Burma, India.

Prof. F. V. Theobald, Professor of Agricultural Zoology, London University, Wye, Kent.

H. N. Thompson, Chief Conservator of Forests, Nigeria.

T. Thornton, Assistant Superintendent of Agriculture, Northern Provinces, Nigeria.

Prof. J. A. Todd, University College, Nottingham.

C. A. H. Townsend, Director of Agriculture, Punjab, India.

Agricultural Society of Trinidad.

Department of Agriculture, Trinidad.

W. H. Trollope, London.

Maung Po Tu, Township Judge, Bogale, Burma, India.

W. S. D. Tudhope, Director of Agriculture, Gold Coast.

E. H. Turnbull, London.

W. J. Tutcher, Superintendent, Botanical and Forestry Department, Hong Kong.

The United Thomas Phosphate Works, London.
Dr. A. H. Unwin, Conservator of Forests, Eastern Province, Southern Provinces, Nigeria.
J. M. Vaughan, London.
N. J. Vavilov, Higher Agricultural School, Moscow.
A. Vellil, St. Denis, Réunion.
J. de Verteuil, Superintendent of Field Experiments, Trinidad, British West Indies.
Senhor F. A. Vieira, Brazilian Consul-General, London.
E. Lejeune Vincent, Brussels.
Prof. Dr. A. Voigt, Direktor des Hamburgischen Instituts für angewandte Botanik, Hamburg.
L. A. Wainwright, Diss, Norfolk.
F. C. Walker, Huyton, Lancashire.
H. C. Walker, Deputy Conservator of Forests, Burma.
Prof. R. Wallace, Professor of Agriculture and Rural Economy, Edinburgh University.
Wallace Brothers & Co., London.
Dr. F. Watts, C.M.G., Imperial Commissioner of Agriculture for the West Indies, Barbados, British West Indies.
Capt. R. V. Webster, Hambleden, Buckinghamshire.
C. E. Welldon, London.
G. S. Whitby, Kajang, Federated Malay States.
A. Wigglesworth, London.
E. Wigglesworth, London.
E. de Wildeman, Directeur du Jardin botanique de l'Etat, Brussels.
Sir James Wilson, K.C.S.I., British Delegate to the International Institute of Agriculture, Rome; London.
N. H. Witt, Wannsee, Berlin.
S. A. Woodhead, Principal, Agricultural and Horticultural College, Uckfield, Sussex.
H. Woog, Paris.
A. M. Wright, Christchurch, New Zealand.
C. H. Wright, Agricultural Chemist, Department of Agriculture, Fiji.
H. Wright, Editor, *India-Rubber Journal*, London.
T. Y. Wright, Galphele Estate, Wattegama, Ceylon.
C. G. A. Wyatt (late Member of the British Guiana Executive Council), London.
R. Zahn, London.
Companhia da Zambézia, Lisbon, Portugal.
Direcção da Companhia da Zambézia em Africa, Quelimane, Portuguese East Africa.

TUESDAY, JUNE 23, MORNING SESSION.

Inaugural Meeting.

THE inaugural meeting of the Congress was held in the Jehanghier Hall of the Imperial Institute on Tuesday, June 23, at 11 a.m. The chair was taken by the President, who was supported on the platform by the principal officers of the Congress, and among others present were Lord Emmott, Lord Sudeley, Sir George Reid, Sir Sydney Olivier, Sir Horace Plunkett, Sir Hugh Clifford, Sir H. Hesketh Bell, Sir Henry Blake, Sir George Denton, Sir Frank Swettenham, Sir Frederic M. Hodgson, Sir James Wilson, Sir William Schlich, Sir W. Haynes Smith, Sir J. Muir Mackenzie, the Hon. C. Gideon Murray, Sir E. Rosling, Mr. J. Arthur Hutton and Mr. Wilson Fox.

The Representatives and Delegates to the Congress (see p. 7) were formally received by the President and introduced to the Congress.

The President then delivered the following

OPENING ADDRESS

By PROFESSOR WYNDHAM R. DUNSTAN, C.M.G., M.A., LL.D., F.R.S.,

President of the International Association for Tropical Agriculture, Director of the Imperial Institute.

My Lords and Gentlemen,—

The International Congress of Tropical Agriculture, which we meet to open to-day, is the third which has been held under the auspices of the International Association for Tropical Agriculture, the first having taken place in Paris in 1905 and the second in Brussels in 1910. At the close of the Brussels Congress the members of the Association did me the honour to elect me as President of the Association in succession to the veteran M. de Lanessan, who, as Governor-General of Indo-China and afterwards as Minister responsible for the French Colonies in the Government of the

Republic, did so much, through his intimate knowledge of the scientific problems of tropical agriculture, to promote its advancement in the French tropics. Fortunately we have continued to enjoy the advantage of M. de Lanessan's advice and assistance in the affairs of the Association which owes so much to his guidance. We all regret that continued ill-health prevents us from welcoming him, the *doyen* of the Association, among us to-day.

I accepted, with considerable diffidence, the honour so generously pressed on me by my Continental colleagues, as among the many responsibilities it involved was that of carrying out the unanimous wish of the members of the Association that the next International Congress should be held in London.

Whatever success the present Congress may achieve is due to the co-operation in the work of organization of the few members of the British Committee who are resident in London, and above all to the unremitting labours of the Honorary Organizing Secretaries, Dr. Henry and Mr. Harold Brown. It is satisfactory that as a result of a year's arduous work an assemblage of distinguished men of all nations and an embarrassing wealth of communications on every aspect of tropical agriculture are the salient features of the Third International Congress of Tropical Agriculture.

His Majesty the King has shown his interest in our proceedings, and has recognized their importance by graciously consenting to become Patron of the London Congress. We have among the Honorary Vice-Presidents, the Ambassadors in London of the Powers concerned in tropical agriculture, His Majesty's Principal Secretaries of State, the Viceroy of India, and other distinguished men who are or who have been connected with administration in the tropics.

The idea of co-operation and interchange of opinion among those of different nationalities who are engaged in the same work and who are working for the same end is undoubtedly a valuable one, and its realization has been productive of most useful results in several important instances, so much so indeed that International Congresses of all kinds, great and small, on all sorts of subjects have become very numerous in

recent years. This is a significant development of the times which no one would desire to deprecate on general grounds. Yet from their great number the danger now is that the importance of those which deal with subjects of great public moment is apt to be overlooked.

There is no subject at the present time in the whole field of human activity which demands greater attention than the organization of those agencies which make for the agricultural productivity of the tropical regions of the world. The subject is of importance to the native races of the tropics who are coming more and more under European control and influence, and who look to European knowledge and experience for guidance in increasing the productivity of the soil.

It is of no less importance to all Governments of tropical countries, which are principally concerned in securing under good governance their material and commercial advancement.

Moreover, the temperate world has to depend on the tropics for the supply of numerous materials which have become necessaries of life and the basis of some of the most important manufacturing industries of modern times.

A Congress which meets to consider and discuss the problems of tropical agriculture in their widest bearings is therefore of the highest importance to all civilized nations. It has been our endeavour to make this, the Third International Congress of Tropical Agriculture, which meets for the first time in the principal city of the British Empire, a thoroughly representative and successful one, of value not only to this country and to the Empire whose tropical interests are so extensive, but also to those other nations whose representatives we welcome here to-day.

I should like very briefly to indicate the principal objects which the British Committee have kept in view in organizing the present Congress. The topics of first importance to the advancement of tropical agriculture have been given a prominent place in the proceedings of the Congress. Education, research, legislative enactments relating to plant diseases, tropical sanitation and hygiene, credit banks and co-operative societies, are to be considered at meetings of the Congress,

as are also such important problems of general interest at the present time as the improvement of cotton cultivation, the fertility of soils in the tropics, the production of fibres, and the preparation of plantation rubber. Sectional meetings will be devoted to the discussion of papers on each important group of agricultural products, where also technical questions connected with soils and manures will be considered.

Special papers on several subjects of general interest will also be given.

The advancement of tropical agriculture must chiefly depend on the labours of the specialist, the practical agriculturist and the investigator, whose contributions form the groundwork of our Congress. It is, however, important that the directions of advance, the nature of the problems to be solved, and the methods which have to be followed in solving them, should be generally understood, and their great importance appreciated by two other classes in the community: by administrators and officials of Governments, and by manufacturers, merchants, and other users of the agricultural products of the tropics.

The advance of tropical agriculture by scientific methods needs the interest and support of those who have the duty and responsibility of administering the Governments of tropical countries, as well as of the users of the raw materials, the representatives of the great manufacturing industries. For this reason the assistance in the work of the Congress has been secured of a number of distinguished Government representatives, and also of manufacturers, companies and firms who make use of tropical agricultural products.

The list of Honorary Vice-Presidents will show that we have enlisted the interest and support for the Congress of a large number of distinguished Government representatives responsible for administration in the tropics.

It has been also the endeavour to bring together scientific and practical authorities on tropical agriculture, representatives of the great tropical planting industries, and representatives of the industrial and mercantile community concerned in the utilization of tropical agricultural products. In this I think we may claim

to have been highly successful. We have a large attendance of tropical agriculturists, scientific and practical, from nearly if not every country concerned. The number of papers on technical subjects is nearly 200, including within their scope almost every aspect of tropical agriculture. It will not be possible indeed within the week which is assigned to the Congress to get through our work unless we can depend on the co-operation of the many authors who are present in person and on those who take part in the discussions in observing the utmost brevity in addressing the meetings, by confining themselves to essential points, and remembering that papers will be printed in the *Transactions* of the Congress.

As it is also hoped to print the principal contributions to the discussions, those who take part in them are requested to assist our work by sending to the Secretaries after the meetings succinct written reports of their remarks.

It has been decided to consider a selection of subjects of general importance at General Meetings of the Congress, and at certain of these meetings it has been arranged for the chair to be occupied by well-known representatives of Governments or of industries, to whom the advancement of tropical agriculture is of vital importance. The improvement of cotton cultivation is to be considered at a General Meeting on June 29, when, I am happy to announce, Lord Kitchener, one of our Honorary Vice-Presidents, will take the chair. Lord Kitchener represents a country in which agriculture is the chief industry, and he has shown the greatest interest in its advancement and that of the great cotton growing industry in Egypt. Following a discussion of problems connected with the preparation and quality of plantation rubber a series of important papers on rubber will be read at a meeting on June 25, at which Sir Edward Rosling, formerly Member of the Legislative Council and Chairman of the Planters' Association of Ceylon, will be in the chair. Questions connected with the cultivation of wheat and other cereals will be discussed at a meeting on the same day, at which Sir Louis Dane, lately Lieutenant-Governor of the Punjab, will take the chair. Co-operative Credit

Societies and Banks will form the subject of another meeting, at which Sir Horace Plunkett will take the chair. Sir Ronald Ross will preside at a discussion on Sanitation and Hygiene on Tropical Estates.

The Congress is especially indebted to the Secretary of State for the Colonies, one of our Honorary Vice-Presidents, who is to preside at a meeting at which the cultivation of cotton is to be discussed. Mr. Harcourt has shown great personal interest and has rendered valuable assistance in the organization of this Congress.

Sectional meetings will be held to discuss papers on cotton, rubber, cocoa, tobacco and fibres. At the meeting at which cocoa is to be considered the chair will be taken by Sir Hugh Clifford, the Governor of the Gold Coast, where cocoa cultivation has made enormous strides in recent years. At the meeting at which papers on Jute and Hemp Fibres will be read Mr. C. C. McLeod, Chairman of the London Jute Association, will take the chair.

A special paper will be read on the Work of the British Cotton Growing Association by the Chairman, Mr. J. Arthur Hutton, at which Lord Derby, the President of the Association, will take the chair. Lord Emmott, Under-Secretary of State for the Colonies and a member of a firm of cotton spinners, will be among the speakers. Other special papers are on The Fibre Industry of British East Africa, by Mr. Alfred Wigglesworth; on The Utilization of Sun Power for Irrigation and other Purposes in Tropical Agriculture, by Mr. Frank Shuman; and on the Karakul Sheep, by Professor Wallace.

In order to get through our work it will be necessary to meet in the afternoons as well as in the mornings, and to commence the proceedings as a rule at 10.30 in the morning, with an interval of about an hour in the middle of the day and of half an hour in the afternoon, the work of the meetings terminating at 6 p.m.

Some Recent Advances in Tropical Agriculture.

In the four years which have elapsed since the last International Congress met in Brussels many important developments in tropical agriculture have taken place

which will form the subject of papers and discussion at our meetings, and to which I shall be able only very briefly to allude in this address.

An immense impetus has been given to the cultivation of rubber, chiefly through the largely increased demand which has arisen for rubber tyres owing to the perfection and general use of motor vehicles. The increased demand occurred at a time when but few of the larger rubber plantations in the East had come into full bearing. A rapid and unprecedented rise in the market price of the raw material took place, and as a result new plantations were initiated in every country, especially in Asia and Africa, in which rubber can be grown, as well as in some places where the chances of success were very small. During this period rubber trees of every description were grown in plantations on a large scale, of which Hevea, Ceara and Castilloa are the most important. A struggle has since been in progress from which we are now beginning to emerge. There has been not only competition between the rubber of these plantations and the rubber derived from the forests of South and Central America and Africa, the result of which mainly turns on cost of production, but there has also been competition between the rubber of plantations of Hevea, of Ceara and of Castilloa, the result of which turns not only on cost of production, but also on the yield and quality of the crude rubbers furnished by these different trees. Certain conclusions are already definitely indicated. One is that the high reputation of the Hevea tree as a rubber producer in countries in which natural conditions are favourable to its growth is established beyond all question. Ceara and Castilloa trees, however, undoubtedly have possibilities in other countries, the climate and soil of which are unsuitable for *Hevea brasiliensis*. The production of rubber from Castilloa trees in plantations is confronted with special problems which are to be discussed at one of our meetings.

It is, moreover, established that under existing conditions rubber from Hevea plantations can be produced at a smaller cost than the same rubber collected from forest trees in the Amazon region of South America.

Two questions remain. One is as to the maintenance of an ample supply of cheap labour for the plantations of the Eastern tropics; the other, with which we are more immediately concerned, is as to the quality of the rubber produced in plantations as compared with that of the rubber obtained from the trees of the forests of South America. The latter question is to form the subject of a special discussion at one of the meetings of the Congress, at which it is hoped that, as the result of an interchange of views between specialists, planters and manufacturers, some further light may be thrown on this important question. I need not now do more than remark that the evidence that plantation rubber obtained by satisfactory methods from well-established trees and properly prepared is equal in quality to that of forest trees is too strong to be doubted. We have yet to learn the precise cause of variations which it is alleged are sometimes shown by plantation rubber, and which are said to interfere with its uses for some manufacturing purposes.

Before leaving the subject of rubber production I ought to allude to the artificial production of this material by chemical means, which has now been satisfactorily accomplished by laboratory methods. It has still to be proved that these laboratory methods can be successfully translated into operations on a large scale, so as to produce commercially rubber of high quality and cheaply enough to compete with natural rubber. The improvement of plantation rubber and the cheapening of its cost are the main problems for the rubber grower. The possible success of synthetic rubber is generally regarded as the bogy of the rubber industry, and the success of synthetic indigo is often quoted as an ominous precedent. It is indeed an important precedent, but in a different sense. The indigo planter did not realize, until it was too late, the fact that improvements in methods of production and cheapening of cost were the vital problems, and that the best hope for the future of the industry lay in the direction of systematic and continuous investigation with a view to the solution of these questions. While these very problems in connection with the production of synthetic indigo were engaging the close attention of investigators in Germany, little or nothing was being

done by planters to improve the natural production. The moral is obvious, and is, I think, fully realized by leading rubber planters. Already important improvements in production have been effected and the cost so considerably reduced on many estates that the commercial success of synthetic rubber seems a highly improbable contingency.

In all industries risks have, of course, to be taken, and there are some against which no human foresight can provide. It has more than once been suggested that it is by no means without the range of possibility that tyres might be constructed on a different principle, involving the use of metal with little or even no rubber. The way to minimize this risk is to extend the industrial uses to which rubber is applied, and definite steps are, it is understood, now being taken to this end.

I have made this brief allusion to the rubber problems of to-day because they point to a condition of affairs which, so long as it is allowed to continue, is a serious menace to the proper progress of tropical agriculture. The extraordinary development of the rubber-growing industry has, from the scientific standpoint, taken us unawares. A large and rapidly increasing industry was suddenly confronted with a number of questions which no one could properly answer, for the good reason that the necessary knowledge did not exist. The exact origin, nature, and functions in the tree of the latex which carries the rubber were not known, and are not precisely known even to-day. These problems belong mainly to the regions of botanical physiology and of chemistry, but had been little investigated. They lie at the root of the many practical questions which arise in connection with the production and flow of latex, the relation of latex production to the nutrition of the tree, and the methods of securing a steady production of latex without undue interference with the vitality and growth of the tree. Little was known as to the effect on the tree of the continuous removal of latex or of the relative effect of different methods of tapping. The consequence was that these investigations have had to be carried out while the plantations waited for the knowledge, which has now been largely gained in part through observations and experiments made by practical planters.

The number of trained investigators in the tropics has been so small that there are large gaps in our knowledge which can only be slowly filled. The entire subject of the science of growing rubber trees in plantations should receive continuous investigation by trained specialists. The fungoid diseases to which the rubber trees are subject and the insect attacks to which they are exposed are no less important to the rubber grower than those which relate to the life history of the plant, its physiology, and nutrition. It must be admitted that the scientific means of defence had not been prepared, and that we were not ready for action at a moment of weakness. To this general question of technical education and research, which is to be considered at more than one of our meetings, I shall return in another part of this address.

Another subject which will claim much of our attention at this Congress is the large and important one of cotton growing and its improvement. Lord Kitchener is to preside at one of several meetings on this question, when cultivation in Egypt will be considered, and at another Mr. J. Arthur Hutton, the Chairman of the British Cotton Growing Association, will give an account of the great work which that Association has done in the last twelve years to extend and improve the cultivation of cotton within the British Empire, and to open up new fields of supply for the mills of Lancashire. Herr Schanz in another paper will describe the advances in cotton cultivation in the German Colonies. Again we are confronted with problems which need for their solution continuous scientific investigation and systematic experiment, and here again adequate means of research were not available in the first instance, and in some cases are not completely provided now. The discovery of a kind of cotton capable of being acclimatized in a new country, and possessing the characters which will render its production profitable, is one which requires time for its solution. In addition to the well-known process of seed selection, the newer methods of plant breeding require to be tried in a well-considered scheme of work in which both practical agriculturists and trained specialists can act in co-operation. Some notable advances have been made, especially in India,

in Nyasaland, Uganda, in French West Africa, and in German East Africa, but the fact cannot be too strongly emphasized that what is needed is continuous effort and experimental work in each country in which cotton cultivation promises success.

Whilst we in this country are naturally concerned in the first instance to improve and increase cotton cultivation within the British Empire, it is to the advantage of all nations that the world's supply of good cotton should be increased. It is of importance, therefore, that those engaged in this work in different parts of the world should occasionally meet together to compare notes and exchange views, and for this reason the value of an International Congress such as this cannot be over-estimated.

In this country at the present time we are specially and financially interested in a large attempt, chiefly due to the initiative of Lord Kitchener, which is about to be made to grow Egyptian cotton under irrigation in the Gezira district of the Anglo-Egyptian Sudan, an enterprise which will require not only sound, practical management, but also careful experiment, close supervision, and cautious advance under the advice of specialists in cotton cultivation.

I think I may safely say that Lancashire spinners, while greatly interested in this enterprise, would view with satisfaction a similar development on the opposite shore of the Mediterranean. Asia Minor, which I visited a few years ago, appeared to me to offer a promising and very large field for the growth of long-stapled American Upland cotton of a type which is in great demand not only in Lancashire, but also throughout the Continent of Europe.

With the advent of irrigation in Mesopotamia additional possibilities for cotton growing in Asia Minor are opened up. With the development of cotton growing in these great tracts, in Egypt, the Sudan, and in Asia Minor the demands of Europe for two of the principal grades of cotton would in a very large measure be met, and the principal manufacturing requirements of the Old World largely derived from within its confines.

In this connection importance must also be attached

to the advances which are being made in improving and extending cotton cultivation in India, which are to form the subject of communications to the Congress.

The dividing line between forestry and agriculture is not easy to draw, especially when we attempt to classify agricultural and forest products. There has been in the last few years an important advance in a subject which lies at present, perhaps, within the domain of forestry, since the materials are largely obtained from naturally occurring trees in the forests. I refer to the oil-yielding trees, especially those which furnish oils suitable for the manufacture of soap or for other purposes. Oils which are edible are now in large demand for the manufacture of those preparations now so widely used in cooking, which under various names are partly or wholly composed of vegetable oils or fats. The result of the demand for certain oils for edible purposes which were formerly used for soap-making has led not only to a rise in the price of these materials, but to a demand on the part of the soap-maker for the supply of other and cheaper oils suitable for his purpose. The oils now in demand include cotton seed, arachis (ground nut), sesame, and some others, which may be regarded as agricultural products, as the plants are grown as crops in the field. Coconut oil, palm oil, and palm-kernel oil are three of the most important of vegetable oils used for soap-making, and more recently for edible purposes. Coconuts have passed into the domain of agriculture, being now cultivated in plantations. The proper cultivation of these palms is a subject of great importance which requires serious attention. The habit, nature of growth, and of nutrition in relation to productivity require study from the plant physiologist; the diseases, fungoid and insect, to which the coconut palm is subject, and the treatment of the soil and manuring of plantations, are matters in which our knowledge is fragmentary and incomplete, and which should receive attention, in view of the great commercial importance of this crop. The West African oil palm is another most important source of two oils respectively derived from the pericarp of the fruits of this palm and from the kernels of the seeds. The oil or fat furnished by the pericarp and roughly

extracted by native methods was, not many years ago, familiar as the orange-coloured lubricating grease employed on railways. At a later period a demand at an increased price arose for its use in connection with soap manufacture. More recently attention has been turned to improvements in extracting and preparing palm oil, with the result that a material devoid of the objectionable colour and flavour of crude palm oil has been obtained which seems likely to be in demand at remunerative prices for edible purposes. The subject of the growth and treatment of the African oil palm is one which is beginning to demand serious study. This question of palm oil is to come before the Congress at one of the sectional meetings, when we shall have the opportunity of congratulating our French and German colleagues on their activities in improving the methods for its extraction, from which more than one British industry will gain.

Before I leave this brief reference to some of the more important advances which have occurred since the Congress met in Brussels, I must refer to a remarkable change which has taken place with reference to the production of cocoa, the principal centre of which is now the British Colony of the Gold Coast. There was an output of 11,407,608 lb. in 1905, when the Congress met in Brussels. It had risen to 45,277,606 lb. in 1910, and last year (1913) it was 113,239,980 lb., and therefore this country now stands first on the list of the cocoa-producing countries of the world. This remarkable result is not merely due to labour difficulties in other cocoa-producing countries; in fact, the Gold Coast is not free from these difficulties itself. It is mainly due to the fact that the climate of the Gold Coast over a large area has proved to be particularly well adapted to the growth of cocoa, whilst the native farmers, with advice and assistance from the local Department of Agriculture, have taken up the subject with great energy and success.

The cocoa industry of the Gold Coast is in fact a notable example of an enterprise which has been brought to success as a native industry aided, and to some extent supervised, by Government, but without pressure or coercion in any form.

A paper on the subject by the Director of the Agricultural Department of the Gold Coast is to be read at one of the sectional meetings of the Congress, when we shall have the advantage of the presence of Sir Hugh Clifford, the Governor of the Colony which looks, under his guidance, to other developments in agriculture, in which he is known to take so great an interest.

If, in concluding this review, I refer to tobacco and sugar, it is only to draw attention to a community of interests in temperate and tropical agriculture, which it was another object of the organizers of this Congress to foster. We are glad to welcome on our General Committee and at our meetings a number of distinguished representatives of agriculture in this country. Tobacco is one of several crops which have taken their place in temperate as well as in tropical regions. It has, of course, been known for long that the tobacco plant could be grown in sub-tropical and temperate regions, but recent developments indicate that certain kinds of tobacco may not only be grown, but successfully cured of satisfactory quality in a number of new areas, among which may be mentioned Canada, South Africa, including Rhodesia, and Ireland, whilst promising trials are being made in this country. The subject is one which needs increased attention in the tropics, especially in relation to the growth of cigar tobacco.

In the short period under review great strides have been made in the region of tropical medicine and hygiene. Our knowledge of several important tropical diseases is now sufficiently complete to enable remedial and preventive measures to be taken with so great a success that, provided certain precautions are taken, life in the tropics is deprived of many of its dangers.

The Imperial Institute a Centre for Information.

As we are assembled for our Congress in the Imperial Institute, I may draw attention to the necessity for a sort of central clearing house for collecting and supplying trustworthy information on all subjects connected with tropical agriculture, and especially with

their technical and commercial aspects. The Imperial Institute during recent years has been identified with investigations and reports chiefly as to the value for technical and commercial purposes of tropical agricultural products of all kinds. A large staff of men who have specialized in these products and their uses are at work in the laboratories of the Scientific and Technical Department.

The Institute is in communication with Agricultural Departments in India and the Colonies on all these subjects, as well as with manufacturers and users of tropical materials at home and abroad, for whose benefit classified sample rooms are maintained, and the important products of the British tropics exhibited in the Public Galleries.

The Imperial Institute is also called upon to afford special information respecting every aspect of tropical agriculture and its products, which it is specially qualified to procure and supply through its communications, both with the countries concerned and with manufacturers. Much of the information thus collected hitherto has been published from time to time in the quarterly *Bulletin of the Imperial Institute,* and in special reports, also published. The work has, however, now grown to an extent which requires a separate organization to cope with it, and this is now being arranged. It is to be known as the Technical Information Bureau, and it will serve as a centre from which trustworthy information with reference to the production and utilization of tropical agricultural materials of all kinds will be issued, and the Bureau will from time to time publish reports for the benefit of the agriculturist in the tropics as well as of the manufacturer at home.

Technical Education in Tropical Agriculture.

I desire now to pass to a subject of great importance to this Congress as vitally affecting both the status and the achievements of tropical agriculture. I refer to the provision of technical education for those who desire to make tropical agriculture the work of their lives. The subject is one which is claiming the consideration of all nations with interests in the tropics, and more especially

of this country, whose tropical interests, direct and indirect, are greater than those of any other nation in the world.

In several countries steps have been taken to provide agricultural education for the natives. I do not propose to deal principally with this question, although reference to it is necessary as the subject is intimately connected with the point to which I desire to direct special attention, which is the technical education of Europeans who are called to fill responsible agricultural positions in the tropics, whether as teachers of natives, officers of Government Departments of Agriculture, or supervisors, managers, or assistants on tropical estates. At the present time the education of men who are to fill these important positions is not definitely provided for, but is left to chance. In order to confine myself within the limits of a Presidential Address in a matter of the first importance which is to receive special consideration in meetings of this Congress, I shall confine my remarks chiefly to this question in its relation to the tropical possessions of Great Britain, and in doing this I wish to emphasize its great national importance.

The agricultural development of British tropical countries has made remarkable strides during recent years. This progress is of especial interest, since it has been achieved in the main by the employment of British capital, several hundred millions sterling being now invested in agricultural undertakings in the tropics. It has, moreover, led to a largely increased output from British sources of some of the most important raw materials of industry and commerce, of which it is sufficient to mention only cotton and other fibres, rubber, cocoa, and tea. As a consequence of British initiative, the natives of the countries concerned have profited through increased trade and general prosperity, and also through the great need which has arisen for the employment of labour on a large scale, under satisfactory conditions and at rates of remuneration which show a steady increase. The native labourer is now fairly remunerated, well treated, and well provided for in matters of food and general sanitation. The native capitalist has been given every facility to embark on agricultural operations on modern

lines, and he owes much to the example and enterprise of the European planter, as well as to the assistance of the Government.

With this material progress has come, somewhat slowly, the recognition of the fact that tropical agriculture is an applied science, and the reflection that progress would have been more rapid and less costly had it been effected more generally under that enlightened direction which depends on the considered application of scientific principles.

Agriculture in Europe is now thoroughly alive to these important considerations, and agricultural education is everywhere regarded as an essential preliminary to agricultural practice. Tropical agriculture has, however, only just reached this position, and its progress so far has been in the main effected by men who have had to learn at their own cost, or at the cost of their employers, the intricacies of a subject in which only accumulated experience and native shrewdness were available as guides. The partial successes of the past afford, however, no reason for delaying an advance which has been made in all other professions, in which a system of technical education has replaced one of apprenticeship. The apprenticed apothecary of the past was successful in his own time, but he is now replaced by the scientifically educated and technically trained physician and surgeon, and no one would dream of reverting to a system of apprenticeship in place of the thoroughly equipped medical schools of to-day. The European farmer and employer of agricultural labour is now usually an educated man who has passed through the curriculum of one of the many efficient agricultural colleges which exist in this country and, indeed, throughout Europe.

The time has come to consider how education in tropical agriculture can best be provided. The opening up of new countries such as East, West, and Central Africa by European enterprise in agriculture has greatly increased the demand for men who are properly qualified to undertake such pioneer work. At present the means of learning the essentials of tropical agriculture usually consist in undergoing, with or without previous knowledge of temperate agriculture, a

system of apprenticeship, in which all the difficulties and disadvantages of this antiquated system of learning are apparent. In what is now known as the Middle East, in India, Ceylon and Malaya, the young man new to the tropics, usually without any agricultural experience, is apprenticed as a "creeper" and learns the ordinary procedure of the estate whilst entrusted with more or less responsible duties of management and supervision. Many of the larger planting companies are beginning to recognize the inadequacy of this plan of providing for the supreme management of estates on which from time to time arise problems which no amount of accumulated experience and judgment are competent alone to resolve. As a result, men are now beginning to be selected as assistants who have previously passed through the course of an agricultural college at home, and who have only to learn the special methods and problems of tropical agriculture during their career as apprentices. This step in selecting partially educated men is a significant and satisfactory advance in the right direction. The men thus selected have received a training in those sciences, such as chemistry and botany, on which the practice of tropical, as of temperate, agriculture depends. They have also gained some knowledge of general agricultural procedure and of estate management, all of which is of distinct value. They are, however, wholly unacquainted with tropical conditions and problems, and know nothing of the existing practice as regards the cultivation of tropical crops, whilst they are wholly ignorant of even the principles of the management of native labour, and of the routine to be followed in the growth of tea, rubber, coffee and cocoa and tropical foodstuffs. The problems and difficulties which confront them in these subjects are beyond their previous experience and training.

It has to be recognized that it is necessary before a man, even with a diploma in European agriculture, can take an effective part in the management of a tropical agricultural estate, or play any important part in improving agricultural methods and solving special problems, or in teaching agriculture to natives, to have been well trained and thoroughly well informed as to

the fundamental facts and conditions of tropical agriculture, which differ widely from those met with in temperate agriculture.

I have referred to the state of affairs as regards the great estates and planting companies all over the British tropics. The position is even less satisfactory as regards the Europeans who go out as teachers in native schools and colleges in the tropics, who, if they have enjoyed the advantage of having studied in an agricultural college at home before proceeding to their duties in the tropics, which is not always the case, are placed in the false position of having to teach agriculture under conditions with which they are wholly unacquainted, and as to which the special knowledge required can, under the circumstances, only be gained whilst they are filling the position of teachers and not of learners. Added to this fundamental defect is that of unfamiliarity with tropical climate and conditions of life and with the mind of the native. After some years a few of these men acquire under unsatisfactory conditions the knowledge required and make efficient teachers, but there is little to be urged in favour of such a haphazard method of dealing with the subject.

The case of Government officials in agricultural departments in the tropics is more serious and even less satisfactory, since men without any experience of the problems of tropical agriculture are often presented as authorities to the native agriculturists. The natives are often men of large knowledge and experience of tropical agricultural practice, which is the foundation from which the European should work. A number of men, especially those with previous agricultural experience at home, have managed during their periods of office to acquire sooner or later the necessary fundamental knowledge and to become efficient officers. This, however, is no excuse for not providing a proper education for such officers adapted to the purposes in view. Experiments and new departures in tropical agriculture cannot be properly made or advice safely given to natives unless the European officer is thoroughly acquainted with the fundamental facts and conditions of tropical practice.

An Imperial College of Tropical Agriculture.

What is now urgently required is an agricultural college in the tropics to which men with the diploma of an agricultural college at home can proceed, to receive a technical education in the subject and thoroughly qualify themselves for the profession of tropical agriculture.

In India agricultural colleges have been founded in recent years, but the courses of instruction provided are chiefly designed to meet the needs of native students, and are not adapted to the purpose of the European student, who comes equipped with some knowledge of general agricultural principles. The same objection applies to the otherwise excellent Agricultural College at Giza in Egypt. In the Southern United States of America several agricultural colleges exist in which special courses are given in sub-tropical cultivation, and where the European student may gain important knowledge respecting the problems of cotton and maize, tobacco and sugar growing. These institutions, not being situated within the tropical zone, do not, however, afford all that special experience and knowledge of certain crops which are essential for the students whose needs are now being considered.

No one who has studied this question in its many aspects can doubt that great need exists for the establishment within the British tropics of at least one agricultural college, properly equipped with all the facilities for instruction and research in the several branches of tropical agriculture. Nor can it be doubted that well-trained men with the diploma of such a college will readily find remunerative employment. Beyond the immediate requirements of the ordinary student such a college should become a most important centre of tropical agricultural research, not merely for its own advanced students, but for trained investigators of special subjects from all parts of the world, who would there find ample materials and opportunities for their researches.

The question, therefore, is how best to realize the conditions necessary for the establishment of such a college. To begin with, it is essential to provide a

thoroughly well equipped central college which shall serve the needs of those countries for which at the present time there is the greatest demand for trained agriculturists. The tropical countries of the British Empire are, however, scattered, and differ much in their agricultural conditions and needs. It is therefore to be anticipated that the successful establishment of one college will be rapidly followed by others in different countries. It can hardly be questioned that, all things considered, the area now called the Middle East has the first and best claim to be the site of such an institution, and that Ceylon is the country best adapted for the purpose. Ceylon is already the centre of a large agricultural community, both native and European. Openings for well-trained men are numerous and well paid, whilst the general conditions of agricultural practice resemble those of the Straits Settlements and Malay States and Southern India, and also afford a satisfactory training ground for the agriculturist in tropical Africa. Ceylon has a variety of climates, and offers illustrations of the growth of a variety of crops. In particular it is a great centre of agricultural production, and occupies a leading position in the tea and rubber production of the world. In addition to presenting a satisfactory climate and a healthy environment for young Europeans, it is within comparatively easy reach of home. It contains at Peradeniya tropical gardens with specimens of the most important tropical plants of the world, and is now provided with a Government Agricultural Department, with a staff of botanical, chemical and entomological experts who would be able to render important service to such a college as is proposed. Without in any way desiring to underrate the importance of establishing a similar college in the West Indies or in other parts of the tropics, there is, I think, general agreement that Ceylon is the colony best adapted in every respect for the establishment of the first College of Tropical Agriculture which will efficiently serve at least the needs of the whole of the Middle East and of Eastern and Central Africa.

The Government of Ceylon is understood to be favourable to the proposal, and the Secretary of State for the Colonies has declared his interest in and sym-

pathy with the scheme. It is welcomed by the large companies whose estates cover so large a part of the island, and who are ready not only to offer paid positions to those who obtain the diploma of the College, but in addition are willing to assist in obtaining the funds required, which, it is estimated, will amount to about £50,000. It is hoped that the Government of Ceylon, as well as the Governments of other countries interested, will give financial assistance to a scheme which promises to have far-reaching consequences in promoting the prosperity of the British tropics, and is not to be regarded as of benefit only to the colony in which the college will be placed, but as serving an Imperial purpose. There is another important reason why the Governments of the Eastern British tropics should financially assist its establishment. In every British colony there exists, at all events, the rudiments of an Agricultural Department, more or less completely equipped for the purpose of conducting experimental work in agriculture for the benefit of the colony as a whole, and of affording assistance and advice to the resident agriculturist, native and European. It is obvious that if such a department is to be in a position to discharge these responsible duties its work must be directed by an officer who is a master of his subject, and who can discuss agricultural problems with as much knowledge as the average agriculturist of the country in which he is to occupy the position of chief agricultural adviser.

It is well known that men fully qualified to act as Directors of Government Agricultural Departments in the British tropics are very difficult and often impossible to secure. Apart from the usual difficulty in finding men who combine some administrative capacity with the requisite technical knowledge, the main trouble is that there is at present no systematic means of educating and training a tropical agriculturist, and the men who to-day occupy these positions are usually botanists or chemists who have trained themselves whilst in office. It is admitted that these men have often been able to render distinguished service, but it must now be recognized that the absence of any system of education under which such officers can be trained for their responsible

duties is one which calls for immediate attention. The present difficulty which Governments find in filling such posts would be removed by the establishment of the College of Tropical Agriculture, since each year a number of thoroughly qualified men with the diploma of the college would be available to select from. There are, therefore, strong reasons why Governments should do everything to support, financially and otherwise, a scheme for providing technical education in tropical agriculture, destined to promote objects which it is to the interest of Governments to secure.

Apart from the contributions of Governments and of companies there is need for private benefaction, especially on the part of the many in this country who owe their wealth to their association with tropical agriculture. It is therefore desirable to give some details of the scheme which has been prepared by the London Committee for the establishment of an Imperial College of Tropical Agriculture.

It is proposed, if the proper arrangements can be secured, to place the College at Peradeniya, in Ceylon, in proximity to the famous Gardens and also to the Government Agricultural Department. Here, at an elevation of 1,600 ft. and in a healthy climate and fine surroundings, will stand the college buildings, with laboratories and lecture rooms. The courses of instruction will be supervised by the Principal. Instruction will be open to all those who produce the diploma of an agricultural college or other evidence of possessing the preliminary knowledge requisite for attendance at such special courses. As educated and otherwise properly qualified native students will be admitted, as well as European students, it is intended to erect by separate subscription in proximity to the college at least two residential hostels, one for Europeans, and others as required for native students, each in charge of a bursar.

In addition to the teaching given at the college, arrangements will be made for the students, in groups, to visit for short periods other agricultural centres in the island, and there study agricultural problems on large estates. The entire course of work will occupy a period of one year, which will be continuous, and

would, therefore, be equivalent to about two years' work at a university or college at home in which actual residence, apart from vacations, does not much exceed six months in each year. In the ordinary sense there will be no vacation for European students in the college in the Tropics, because no vacation is really needed under the conditions of life proposed, whilst the difficulties of providing for a satisfactory vacation in the ordinary sense within the island are considered to be insuperable. Suitable opportunity for recreation will be provided within the discipline of the college. Parents in England who wish their sons to take up tropical agriculture as a career will therefore be assured of a satisfactory supervision during the year of study in Ceylon. The cost of board, residence and instruction for the year is estimated at £150, which having regard to the longer period of the curriculum, is rather less than the cost of an agricultural college at home.

It is very desirable that scholarships should be offered of this value to students at agricultural colleges at home, in order to render easier the special training of the most promising of those students who wish to take up tropical agriculture. Private benefaction might well assist the scheme by providing such scholarships.

It is to be hoped that it may be possible to provide in Ceylon for the realization of the scheme. If not, Southern India offers many advantages, and there are some who desire to see the college founded in the Federated Malay States. In dealing with the question in detail, it is important that certain facts should be kept very clearly in view.

The college should be Imperial in its educational character, and open to properly qualified candidates from all parts of the Empire, without distinction of race.

The college will provide a training and experience in tropical agriculture for those who are already qualified in general agricultural principles and in the sciences connected with agriculture, as evidenced by the possession of the diploma of any recognized college or university.

The Imperial College, while having close relations with the Government Department of Agriculture in the

country in which it is established, should, as an educational institution, be separately organized under the management of a Committee on which all agricultural interests are represented, with a representative governing body in London.

The college should not trench on the domain of local colleges and schools engaging in elementary teaching, but should be a place of advanced learning and research for those who have already received a general agricultural education.

In founding a college to fulfil such important purposes, so closely connected with agricultural advancement, it is hoped that the Governments of the tropical countries will participate, and, having regard to the great national interests affected, it may reasonably be hoped that the Government of this country will give the scheme, when complete, its financial support. The National Exchequer has responded not illiberally to demands for financial assistance for closely allied subjects, such as the advancement of tropical medicine, and it has assisted in the formation of an Imperial Bureau of Entomology.

Closely connected with, though distinct from, the establishment of such a college on satisfactory educational lines is the provision of suitable accommodation for European students, and of a proper discipline during their residence in the tropics. In the first instance, at all events, the large majority of the students will be young Europeans who will be new to life in the tropics, and who will need at least as much care, attention, and discipline as they receive in a college or university at home. The question of the erection of hostels or boarding-houses and their management is one for consideration apart from the establishment of the college. Whilst the duty of erecting and establishing the college is one which should devolve principally on the Governments of the countries concerned, and partly on the planting companies and firms interested, it seems desirable that the hostel for European students, though subject to the Board of Management of the college, should be endowed by separate European subscription.

The establishment of an Imperial College of Tropical Agriculture is to be considered at this Congress, and it

is hoped that as a result further co-operation will be secured for a project which is of vital importance.

A British Institute of Tropical Agriculture.

In dealing with the question of proper provision for technical education in tropical agriculture, as well as in considering other matters of importance to the subject, advance is retarded by the absence of any unofficial society or institution in this country which can claim authority to speak in the interests of British tropical agriculture, and represent the opinions and promote the interests of those who are engaged in what ought to be regarded as an honourable profession. The matter is outside the sphere of any Government institution, and the International Association for Tropical Agriculture, by reason of its constitution, obviously cannot assume these duties; in fact, British relations with the Association are hindered by the absence of any British society of the kind. Surely the time has come for the formation of a society comprising all interests in a subject which is so profoundly connected with the welfare of the Empire.

I desire to submit to the British Section of the Association for its consideration, and for such action as it may consider expedient to take, the question as to whether it is not desirable to proceed to form a British Institute of Tropical Agriculture, whose functions would include the holding of meetings for the reading of papers, the discussion of all matters concerning tropical agriculture, and the consideration of education and qualification for the profession, and, in fact, doing whatever it may consider desirable to promote the interests of the subject of tropical agriculture, and of those who are engaged in it. My own experience in the period of twenty years during which I have been closely in touch with the subject, and with those who are working for it in all parts of the world, has led me to the conclusion that action in this direction is much needed, and that the establishment in this country of such an institute on the lines of those of other professional bodies, such as the Institutions of Civil, Mechanical, and Electrical Engineers and the Institute of Chemistry, and many

others, would be welcomed by all those who, as specialists, planters, merchants, or manufacturers, are connected with the subject of agricultural production in the British tropics.

A British institute of the character indicated would, of course, be affiliated with the various agricultural societies in the British tropics and with the International Association, and would, with great advantage, take over the work at present performed by the British Committee of the Association.

The best methods by which those countries which are connected with the International Association can co-operate in its work and strengthen its action are to be considered at a meeting of the members of the Association at the close of this Congress. I feel satisfied that the large work which lies before the International Association will be best promoted by a scheme involving the affiliation and close co-operation of a society or institution in each of the European countries interested in the advancement of tropical agriculture, and our Continental colleagues have expressed the wish that this opportunity should be taken to elicit the views of the British members on this important subject.

Government Departments of Agriculture.

The organization of Government Departments of Agriculture is a subject of much importance, intimately connected with that of technical education. I referred to some of its aspects in a Presidential address to the Section of Chemistry and Agriculture at the meeting of the British Association in 1906. It must be admitted that generally in the British tropics the organization of Agricultural Departments is still primitive and wanting in principle. Owing to causes to which I have alluded, it is not easy to find a supply of men educated and otherwise qualified to fill official positions of authority in the subject.

It is now recognized that the Director of a Government Agricultural Department in the tropics, or, as he is more usually called, although with some risk of misunderstanding, the Director of Agriculture, should

be a man of experience in the practice of tropical agriculture, with such a knowledge of the sciences on which the practice of agriculture depends as will enable him to understand when and how to call to his assistance the members of his staff who are specialists in those sciences. He must also possess administrative ability and the power of organization. Without this link in the Head of the Department between the scientific staff and the practical agriculturists of the country, whether native or European, the Department will lack effectiveness. A mere assemblage of specialists without a leader versed in agriculture will fail to effect that influence on the advancement of the agriculture of a country which is one of the most essential and at the same time one of the most difficult functions of a Government Department. It sometimes happens that a specialist, it may be a botanist, a chemist, or an entomologist, has sufficient interest in agricultural practice to make it his study, and if he also possesses other qualifications he becomes a distinguished Director of Agriculture. There are several examples in the British Colonies of such men who have done and are doing eminent service for the advancement of agriculture in their respective countries. These, however, are brilliant exceptions to the rule that a definite system of educating and training tropical agriculturists is better than a want of system in which the right man may eventually emerge by chance. Much the same state of affairs which exists in British countries has until lately been the rule in other parts of the tropics. It is clear, however, that everywhere the movement is now towards a more systematic plan which only needs the provision, through the establishment of a Central College, of the means of technical education in order to secure its general adoption.

The problem of securing as head of an Agricultural Department a man with a broad outlook as well as administrative ability has found a different solution in India. In India the head of a Provincial Department, called Director of Agriculture, is a member of the Indian Civil Service, usually without any knowledge either of agriculture or of any of the sciences on which it depends. He has complete control of the Department

and of the specialist staff. He has as second in command, an agricultural specialist with the title of Deputy Director of Agriculture, on whom must actually, though not nominally, fall the real initiative and control of the Department. The system can only be justified, or rather excused, by the real difficulty of finding trained agricultural officers with those other qualifications which are essential in the head of a Government Department in India, and by the circumstance that besides technical agriculture there are usually involved in the work of the Department purely administrative and legal questions relating to land, with which an Indian civilian is best qualified to deal. I have been in touch with this system for a number of years, and during a recent visit to India I have had further opportunities of studying it.

It must be admitted that occasionally an Indian civilian has taken great interest in agricultural work and has made himself an efficient and sympathetic head of the Department. In general, however, the plan has many drawbacks, and so long as it is adopted the best men will not be attracted to the Indian Agricultural Service in spite of the pecuniary advantages which it offers as compared with the Agricultural Service of the British tropical colonies. I am informed that it is possible for a Deputy Director of Agriculture in India to become the Head of the Department. I am, however, not aware of any instance in which this has actually happened, although the Deputy Director may act as the head of the Department in the temporary absence of the Director. So far as I am aware an actual vacancy is generally, if not invariably, filled by the appointment of a member of the Indian Civil Service.

Admitting the difficulties at the present time which stand in the way of the creation of self-contained Agricultural Departments in India, I venture to think that some change is now called for in the existing plan. If it is considered impossible to form a separate Department for dealing with administrative and legal questions connected with land tenure, I am inclined to suggest that an alternative might be found in the formation in each Province of a small Board of Agriculture, composed of official and non-official members, of which

an Indian civilian would be the Secretary. The non-official members might well be Indians chosen on account of their interest in the subject. The Director of Agriculture, who would be responsible to this Board, would have full charge of the specialist staff, and would be directly concerned with the technical work of the Department and with the reports which it issues.

The advantages of this system would be that whilst reserving to the Board the consideration of general questions, including those relating to land tenure, the Agricultural Officer would receive his proper title of Director of the Department and would have the direct charge of the whole of its technical work and be directly responsible to the Board, whose meetings he would attend.

The Government would still have the advantage of the administrative experience in other than technical questions of the Secretary and the members of the Board, the Secretary being an Indian civilian with a title, Secretary to the Board of Agriculture, more in accordance with his proper duties.

The inclusion of Indian members in the Board would have the great advantage of securing their interest and co-operation in the agricultural advancement of India, which is so much to be desired.

It is almost a truism that investigation and research should be vital parts of the work of Government Agricultural Departments. The fact that so little is being done in the tropics makes it, however, necessary to consider the question, which is to be discussed at one of our meetings. By research in this connection is not meant the trials and plot experiments which form part of the regular routine work of an Agricultural Department, but the attack and concentration on definite problems by qualified specialists. The reports issued by the various departments of agriculture in the tropics, British and other, show that, in general, scientific investigation is not definitely provided for, and that the energies of the usually small staff are being entirely occupied with routine work. It is not everyone who is inclined or qualified to deal with the larger questions which await solution as the result of systematic experiment in tropical agriculture, but where such men exist, and they should exist in all

Departments, the necessary facilities and assistance should be provided. It will no doubt be said that this involves additional expense, but it is expense which it is well worth while to incur in the interests of the countries concerned.

The amount of expenditure in connection with Government Agricultural Departments in the British tropical colonies, though greater than it was, is still very small in relation to their importance, and to the large amount of valuable work which is being done.

In India the College for higher instruction and research, established at Pusa in Bengal, is now entirely devoted to research on questions of general importance to India. The Central Research Institute, as it is now called, is performing work of great value to Indian agriculture as a whole. At the same time its efforts should not lead India to overlook the fact that with the great diversity of conditions which prevail throughout that great continent, research is also called for in each of the Provincial Departments of Agriculture, where scientific investigation should be chiefly directed to problems of local importance. The results of investigations conducted in one district of Bengal often require re-investigation in their relation to different conditions in other places. The Research Institute at Pusa cannot in any case be expected to deal with all the agricultural research which is called for throughout India, and the prosperity of the Provincial Departments of Agriculture is intimately connected with the power which is given to them of acquiring new knowledge with special reference to problems of local importance.

The International Congress and the International Association.

The deliberations of the Congress are to extend to a large number of important subjects relating to the various aspects of tropical agriculture and industries. It will be within the province of the meetings of the Congress to recommend the appointment of Special Committees to collect information on any subject in which it may be considered useful to take action with a view to a report being presented either to the next

Congress, or before that event for publication by the International Association.

I have ventured to suggest three questions of general importance for special consideration which it may be convenient to deal with in this way.

(1) The establishment of an Imperial College of Tropical Agriculture, (2) the formation of a British Institute of Tropical Agriculture, which more particularly concerns the British Section of the International Association, and (3) the question of the constitution of the International Association considered as a federation of Central Societies in the capitals of European countries, in communication with Agricultural Societies and Institutions in the tropics.

I may now bring this address—already, I fear, too long—to a close with an expression of the hope that the first meeting of the Congress in the capital of the British Empire may result not only in a satisfactory interchange of views between the representatives of various nations and the advancement of several important matters of tropical agriculture, but also contribute to the formation of those personal friendships between agriculturists of different nationalities which have such a powerful influence in promoting that extension of knowledge which is our common desire.

The Right Hon. Sir GEORGE REID, G.C.M.G. (High Commissioner for Australia): Mr. President, my Lords, and Gentlemen—When I was very reluctantly emerging from my slumbers this morning I was confronted with a letter from your two invaluable Secretaries, sending me a copy of the President's address, and asking that I should move a vote of thanks. Now there are several reasons why I at once accepted this task. In the first place I am fully aware, as the representative of Australia in this country, of the intense zeal and ability with which Professor Dunstan fills his highly responsible and publicly useful post as Director of the Imperial Institute.

I do not think I have ever seen this Imperial Institute to greater advantage than I do just now, in the presence of this remarkable and distinguished assembly of the representatives of tropical agriculture of all nations. Now I had another reason for accepting the task at

once. I am profoundly ignorant of the subject; therefore I have accepted the conclusions of the President implicitly.

Now, if you are going through that programme which has been set down to be discharged in a week, you will have to do several more sensible things than any other body of men that I know of has ever accomplished. You must not adopt parliamentary methods. You must consider that all the general observations that are necessary for each of you have been uttered for all of you in this Presidential address; and then you need not individually assure us that you are not competent for the tasks which you undertake.

Personally I am delighted that the marvellous and hitherto obscure resources of the tropical soil are beginning to be enlightened by science; and one of the grandest things about this task and these subjects is that they equally promote the welfare of all the races and all the countries on the face of the globe. Agriculture seems to me to have always been the Cinderella of human enterprise and investigation. What a great thing it is that men of science, and intellect, and research, are beginning to exploit these magnificent resources of creation. Then, when I listened to the references of the President to rubber, I could not help hoping that some day a similar Congress will assemble in order to endeavour to establish, on behalf of the producer and the public, a more equitable distribution of the profits. When the price of rubber went up with marvellous leaps and bounds, I saw the upward progress faithfully reflected in the accounts which I received for motor tyres. I understand the price of rubber has come down tremendously of late years, but I see no downward tendency in my bills for motor tyres. I do not suppose you have time to deal with that subject just now.

I again say that this is a grand Congress, with grand objects in view, and I wish it every success.

Sir Hugh Clifford, K.C.M.G. (Governor of the Gold Coast): Mr. President, my Lords, and Gentlemen —To me has been confided the task of seconding the motion which has been put to you with so much eloquence by Sir George Reid. He speaks for the Great

Dominions; I, I take it, am appointed to speak to-day on behalf of the Crown Colonies, most of which, as my brother officers are aware, are situated in deplorably hot and often deplorably damp localities—which are peculiarly suitable to agricultural production. And it is because, in these climates, agricultural products are evolved in such luxuriance, that to us who are associated with the Crown Colonies in the tropical zone, agriculture has perhaps the greatest importance of all the matters that come under our consideration. In the Colony over which I have for the time being the honour to preside, a very remarkable development has, as your President has told you, recently taken place. During the last year the Gold Coast Colony has produced considerably more than one-fifth of the total cocoa crop of the world. But what makes this so peculiarly remarkable is that there is not at the present time a single cocoa garden from one end of the Gold Coast to the other which is owned or managed by Europeans; that that great industry and that great development has been from first to last in the hands of the natives themselves, and up to the present time they have only received very scant aid at the hands of the Government. During the last few years an Agricultural Department has been established in the Colony, and its officers have, with the greatest zeal, visited all parts of the Gold Coast, and have personally advised the natives in the cultivation of their crops. But that is comparatively speaking an entirely new development, and in many other countries I think it will be found that a similar experience has been ordinary. That is to say, that the planter, be he European or be he native, has in the first instance initiated the industry, and it is only at a long distance of time that the Government has come to his assistance with scientific aid and advice. Now that is something which, though it has happened in the past, we hope will not be repeated in the future—and it is for the purpose, I take it, of marking out for ourselves a policy of development in agricultural knowledge and instruction that this great Congress has been called together to-day. And, if I may say so, it could hardly have met in any circumstances in an institution better suited for its accommodation, or under a Presidency more fitting than

that of Professor Dunstan. Like Sir George Reid, I have known Professor Dunstan for a considerable number of years, and we are all of us aware of the great record which he has made in connection with the Imperial Institute. The Imperial Institute, for some years after it had been initiated, existed very beautifully, but as far as the Colonies were concerned no great things came out of this mountain which had been erected in this City of London as an Imperial Institute. And it is due mainly to the initiative of Professor Dunstan, and to the energy, zeal and enthusiasm which he has brought to bear upon the task entrusted to him, that the Imperial Institute to-day is not only a monument in the City of London, but is also a place where information is to be obtained, by the manufacturers and producers concerned, with regard to tropical products. The utility of this Institute, which is known to all of us who are well acquainted with the tropics, is due almost entirely to Professor Dunstan's individual exertions since he became the head of it, and therefore he has unquestionably earned the gratitude of all of us who are interested in the development of the tropical Colonies, and in your name, ladies and gentlemen, I beg to second the vote of thanks which has been proposed by Sir George Reid.

The Right Hon. Lord EMMOTT, G.C.M.G. (Under-Secretary of State for the Colonies): My Lords and Gentlemen—I did not come here for the purpose of speaking this morning, but for the purpose of listening to the address which Professor Dunstan has given in opening the proceedings of this Congress. But may I say on behalf of His Majesty's Government how we welcome your presence here to-day, and particularly the presence of those many gentlemen who have come from other countries over the seas in order to take part in this Congress? I may say that His Majesty's Government takes the greatest possible interest in the deliberations on which you are about to enter, and will follow your proceedings very closely. We have every hope that this Congress will prove as successful as its predecessors in drawing attention to the very important problems connected with tropical agriculture. I think the *locale* of your meetings has

been most happily chosen in this Imperial Institute, and I think your President has been most happily chosen in the person of Professor Dunstan. I am quite sure that you have all of you listened to his address this morning with the greatest possible interest. I do not know, gentlemen, whether I ought to condole with or congratulate you on the fact that you are opening your Congress this morning at a time of unusual political interest in this country. It is by accident rather than design that that has happened, but I refer to it at this moment for this purpose. I am afraid that the political engagements of many of us who are members of one or other House of Parliament are such at the present moment that we shall not be able ourselves to attend some of the meetings of this Congress that we should have liked to attend. For myself, greatly to my regret, I shall be unable to be at the Congress this afternoon, when the question of cotton is to be dealt with. If any observations of mine are required, I have written out, and they can be read on that occasion, some very short observations dealing with that question. But I want to take this opportunity of apologizing for the fact that I am unable to be present this afternoon on account of the great importance of the proceedings of the House of Lords.

Now, gentlemen, I will not detain you longer, but will ask you to express your very hearty thanks to Professor Dunstan for the Address with which he has opened our proceedings this morning.

The resolution was carried unanimously.

The President: My Lords and Gentlemen—I desire to thank you and Sir George Reid and Sir Hugh Clifford for their very generous words, and also to thank Lord Emmott for his kindness in coming here this morning at some inconvenience to represent the Colonial Office at the opening meeting of our Congress, in the unavoidable absence of the Secretary of State. I can only say it has been a great pleasure, as well as a great honour, to me to have to address such a distinguished assembly as this, and I apologize for having been obliged on account of time to abbreviate my address to some extent. But I hope to have opportunities in the course of the Congress of saying some of the things I have been obliged to leave unsaid this morning.

TUESDAY, JUNE 23.—AFTERNOON SESSION,
2.30 P.M.

Technical Education in Tropical Agriculture.

Chairman: THE PRESIDENT.

THE following papers were read:—

TECHNICAL EDUCATION IN TROPICAL AGRICULTURE.

By GERALD C. DUDGEON, F.E.S.,[1]

Consulting Agriculturist to the Ministry of Agriculture, Egypt; Vice-President of the International Association for Tropical Agriculture.

[ABSTRACT.]

The rapid growth of plantation work in the tropics demands the services of qualified technical men in order to obtain the best results.

The available supply of men is limited to those who have previously been employed on plantations, or to men from agricultural colleges often with too little knowledge of the requirements to be of immediate use in tropical agriculture.

A smaller, though important, demand for men qualified in tropical agriculture, for Government service, has also sprung up. Until comparatively recently such posts in the British Colonies and Protectorates were filled by certificated Kew men, but more recently men trained in British agricultural colleges have been sent to study for a short term in Ceylon with the Government Agricultural Department, and afterwards to the colonies to fill Government posts.

It is proposed that higher colleges of agriculture, one in the East and another in the West Indies, should be provided and

[1] In the absence of Mr. Dudgeon this paper was read by Dr. L. H. Gough, Ph.D., F.E.S., Chief, Entomological Section, Ministry of Agriculture, Egypt.

that students holding British agricultural diplomas should be admitted to the courses. It is suggested that for the Eastern college Ceylon presents certain advantages, but it is emphatically insisted on that if the training is intended to be suitable to qualify men for employment in East and West Africa, India, Malay, Ceylon, and other tropical countries, the curriculum must be carefully prepared so as not to permit the requirements of Ceylon alone to predominate unduly, those for East and West Africa and India being rather different. The subjects which it should be compulsory for students to graduate in are indicated, and an example is given showing, with respect to a tropical plantation product, what lines of teaching are necessary as well as what other subjects are useful if not indispensable for training in plantation work.

GLI STUDI DI AGRICOLTURA COLONIALE IN ITALIA.

Per Dott. Gino Bartolommei Gioli,[1]

Direttore, Istituto Agricolo Coloniale Italiano.

[Abstract.]

L'Autore riassume l'interessamento sempre crescente degli studiosi italiani ai problemi di agricoltura coloniale, man mano che l'opera di espansione dell'Italia all'Estero veniva intensificandosi sia coll'occupazione di colonie di dominio diretto in Africa, sia coll'aumentare dell'emigrazione fondiaria nei paesi d'oltre mare.

Nella comunicazione vengono esposti i criteri con cui sono stati fondati gli Uffici Agrari Sperimentali dell'Eritrea, della Somalia e della Tripolitania, vengono elencate le principali Missioni di studio che hanno percorso i possedimenti italiani collo scopo di accrescere le cognizioni sulle risorse dell' ambiente fisico e di iniziare le ricerche per stabilire le possibilità di una adatta colonizzazione delle terre. Così i problemi agricoli, zootecnici e forestali nonchè quelli che si riferiscono ai grandi fattori della produzione agraria nelle colonie italiane sono oggi sulla via della risoluzione, anche perchè nella Metropoli le Istituzioni agrarie coloniali attendono da qualche anno allo studio scientifico del materiale, che dai Governi coloniali e dai coloni viene inviato agli studiosi incaricati.

[1] In the absence of Dr. Gioli this paper was read by Dr. O. Manetti, Vice-Direttore, Istituto Agricolo Coloniale Italiano.

Nell'ultima parte della communicazione l'Autore si intrattiene appunto a parlare della storia dell'organizzazione degli Istituti scientifici metropolitani, che si occupano di agricoltura coloniale. Tra questi l'Istituto Botanico e Museo Coloniale di Roma, importante soprattutto per le collezioni della flora eritrea, il R. Giardino Coloniale di Palermo colle sue magnifiche colture di piante tropicali in pien'aria e l'Istituto Agricolo Coloniale Italiano di Firenze, di cui l'Autore è il direttore fondatore, e che rappresenta il massimo centro di studi coloniali in Italia.

[TRANSLATION.]

THE STUDY OF COLONIAL AGRICULTURE IN ITALY.

The writer refers to the ever-increasing interest of Italian students in the problems of colonial agriculture, which kept pace with the expansion of Italy abroad, not only by the occupation of colonies under direct dominion in Africa, but also by the increase of agrarian emigration to oversea countries.

In this communication are discussed the principles on which the Experimental Agricultural Departments in Eritrea, Somaliland, and Tripoli have been founded; a survey is given of the principal scientific commissions which have visited the Italian possessions with a view to gaining a knowledge of the resources and physical characteristics of these possessions, and to initiating researches in order to establish the possibility of a suitable colonization of the land. In this manner the agricultural, zootechnical, and forestry problems, as well as those relating to the great factors of agrarian production in Italian colonies, are now on the way to being solved. In the mother country the Colonial Agricultural Institutes have been devoting themselves, for some years, to the scientific study of the material sent home, by the Colonial Governments and the Colonies, to the students charged with this work.

In the latter part of his communication the writer deals especially with the history of the organization of those scientific institutions at home which occupy themselves with colonial agriculture. Amongst these institutions are the Botanical Institute and Colonial Museum of Rome, which is of particular importance by reason of its collections of the flora of Eritrea; the Royal Colonial Garden of Palermo with its magnificent cultivation of tropical plants in the open; and the Italian Colonial Agricultural Institute of Florence, of which the writer is the founder and director, and which represents the largest centre for colonial studies in Italy.

THE NECESSITY OF ESTABLISHING A BRITISH AGRICULTURAL COLLEGE IN THE WESTERN HEMISPHERE.

By Harold Hamel Smith, *Editor of "Tropical Life."*

[Abstract.]

I am not urging the claims of the West Indies as a competitor with Ceylon, but because I am certain that, if the United Kingdom means to enjoy that share of the ever-increasing commerce of Latin-America to which it is entitled, we must have two colleges, one in the East, say in Ceylon, and one in the West, say in Trinidad.

Estimates as to the cost of a college, as well as of the annual amount necessary for its upkeep, vary, but our esteemed President, Professor Dunstan, estimated that £50,000 would be needed to place the Ceylon College on a secure basis. If it is so in the East, it certainly would be so out West, and this means that someone has to put down a hundred thousand sterling to establish two colleges. Those who do so will get better value for their money than even the shareholders receive in any three of the best paying rubber estates, although they have already got back their capital several times over. There is, of course, only one source from which such a sum can come, namely, the general public, who will benefit by the establishment of the two colleges in every possible way, both as regards the assurance of increased supplies of raw materials for their factories, as well as the large shipments of foodstuffs which we now draw weekly and daily from the tropics, and without which the bulk of the population in this country and the world generally would find it difficult, if not impossible, to exist for more than a few months. The importance, therefore, of scientifically training tropical agricultural experts and planters is not confined to any one country, but is quite international in character.

Before going on to discuss the class of student that I am hoping to see make use of these colleges, I would like to call your attention to the fact that, according to the *South American Journal*, we have £1,001,756,565 sterling invested in Latin-America, and we need, therefore, a largely increased number of planting and trading experts out there to control and make good use of this huge sum to the advantage of this country.

A strong point also in favour of a second college to be established in the West Indies is the fact that experts and planters going to West Africa could well be trained there,

since many men who have been trained in the West Indies, and especially in Trinidad, are doing well in West Africa, which, with Equatorial Africa generally, is one of the most, if not actually *the most*, important tropical centres affecting British interests in the world; and as it would be impossible to train whites properly in Equatorial Africa, they must come down to a Trinidad College as being the centre most accessible and surrounded by the class of labour and conditions generally most closely resembling those that prevail in West and Equatorial Africa.

I attach this importance to tropical Africa because we are told that South Africa is getting drier every year, and that this has generally been ascribed to the destruction of trees; and as the Royal Commission on Indian Finance tells us that the monsoon to which India owes so much, and on which the food of millions is dependent, is derived from the heart of Africa,[1] not only, therefore, is it necessary to make the question of the deforestation of Africa a national one, but even an international one, as otherwise famine and death will come, sooner or later, to Africa and India alike; and since we cannot train our experts in Africa, I maintain that Trinidad or elsewhere in the Western Hemisphere offers the most suitable site for an Agricultural College for Englishmen going to Africa as well as to the West Indies, and Latin-America generally.

The following papers were taken as read:—

AGRICULTURAL EDUCATION AND ITS ADJUSTMENT TO THE NEEDS OF THE STUDENTS.

By Francis Watts, C.M.G., D.Sc., F.I.C.,

Imperial Commissioner of Agriculture for the West Indies.

[Abstract.]

This paper, while dealing with the question in a general manner, has as its basis the conditions of tropical agriculture in the British West Indies.

In discussing agricultural education there is often a want of precision of thought as to the class of pupil under consideration and the purpose for which he is to be trained; as a consequence the training suggested is often ill-adjusted to the educational and social status of the pupil and to his subsequent life's work.

[1] In the same way as Sir Ernest Shackleton tells us the ice season in the Antarctic affects the rainfall of Chile and Argentina.

The paper attempts to outline the phases of agricultural education available, or capable of being readily made available, in several British West Indian Colonies.

Consideration is given first to the teaching bearing on agriculture in elementary schools: it is urged that little attempt should be made to give a technical aspect to the teaching, which should consist mainly in making the elementary scholars, who are largely of the peasant class, familiar with the common objects and events of an agricultural district. Simple operations connected with the growing of plants may be demonstrated and practised, and some of these exercises may take place in a school garden. This affords a sufficiently wide scope without attempting details of technical agriculture, and provides as much as is required by the peasant who is to become an agricultural labourer.

A certain number of pupils from the elementary schools require to receive further training in agricultural matters in order to fit them for the higher ranks of the labouring class who, in a minor degree, superintend the work of labourers, the so-called drivers or head men of the West Indies. These, who in the organized scheme now in existence are styled Agricultural Pupils, can best receive training at some institution where practical agricultural or horticultural work is carried on for purposes other than teaching. In the British West Indies this is successfully done in connection with the botanic gardens and experiment stations.

The education offered to the scholars attending the secondary schools, those of the grammar school class, consists in a good all-round training in English subjects, elementary mathematics, one classical and one modern language, coupled with instruction in elementary sciences fundamental to agriculture, such as chemistry, physics and biology. As in the elementary school, so in the secondary, little can be done in the teaching of technical agriculture.

A good general training in practical agriculture is given by means of a system of Cadetships to a selected number of scholars who wish to follow agricultural pursuits. The cadet remains attached to the secondary school for purposes of discipline; he also continues to receive instruction there in a limited number of subjects; the remainder of his time is occupied in practical work at the botanic gardens and experiment stations, where he learns the methods of cultivating the crops of the district, to make and keep records of work and experiments, to supervise labour, to conduct correspondence, and so forth.

In a few instances posts of minor responsibility at the institution are filled, for a limited time, by cadets who vacate

these posts at the end of a fixed time in order to make room for others.

A scheme of reading courses followed by examinations has been successfully instituted by the Imperial Department of Agriculture for the West Indies, and followed with modifications independently in some colonies; the Imperial Department of Agriculture scheme makes it a condition for examination that the candidate (except the preliminary) is practically engaged in agricultural work in the subjects (crops) in which he is examined; mere book work will not suffice to gain admission even to examination. The examinations are divided into three grades, Preliminary, Intermediate, and Final, with three classes in each grade. The grades are intended to correspond with the three vocational grades of West Indian planting life: Beginner, Overseer (or Book-keeper), and Manager.

The establishment of tropical agricultural colleges is advocated and their scope and functions indicated. Stress is laid on the point that consideration must be given to the life-work ultimately to be undertaken by the student in framing his college course, that regard must be had to the working farmer or planter, who requires only moderate training in sciences, but who must be afforded means of studying and practising agriculture as an *art:* hence for this class of student an agricultural college must either possess, or be associated with, a considerable area of land whereon the agricultural operations common to the district are carried out on a commercial scale. Regard must also be paid to the training of the scientific experts who look forward to being ultimately engaged in specialized work connected with agriculture, as advisors on special subjects, *e.g.*, chemical, entomological, mycological, etc., and not as working farmers or planters. These students require different provision from the former, and are not to be confused with them as sometimes would appear to be the case.

For adequate teaching and for the advancement of knowledge it is very desirable that an agricultural college should be associated with something in the nature of an institute for agricultural research; it would be well if the Institute for research could be regarded as the main affair and the teaching be grouped around it.

From what is stated it follows that agricultural colleges cannot well be established and maintained by small communities; they imply a large, well-trained, and well-equipped professional staff and a large number of students to justify the existence of such a staff. In the case of a tropical agricultural

district, easy of access from Europe, and with easy means of communication with other adjacent tropical areas.

Some provision for post-graduate study is already available through the medium of the Imperial Department of Agriculture for the West Indies in association with the botanic gardens and experiment stations of the several colonies, aided by the liberality of several proprietors of plantations and factories who permit facilities for study. Several students have already availed themselves of these opportunities.

It is claimed that there is real need for the endowment of tropical agricultural research and education, and there is reason to believe that this would yield a rich harvest to the country making this provision.

ELEMENTARY AGRICULTURAL SCHOOLS FOR NATIVES IN THE BELGIAN CONGO.

By Professor Edmond Leplae,

Director-General of Agriculture, Colonial Office, Belgium.

[Abstract.]

The natives of the Belgian Congo are still in a semi-wild state, and although they nearly all practise agriculture, their crops are exclusively food crops.

The development of the colony and the welfare of the natives themselves make it very desirable that they should learn to grow some crops for export, such as cotton, cocoa, coconuts, rubber trees, ground nuts, coffee, kola, etc.

A trial was made at the Eala Botanical Gardens, where a school of agriculture was started a few years ago. This attempt was not successful, on account of the pupils being too old (fifteen to twenty years of age), and the programme too elaborate (French, arithmetic, writing, geography, etc.).

This school has been closed lately, and agricultural education is contemplated on quite a different basis.

A great number of elementary schools would be founded, with native teachers, under the supervision of the missionaries. A small sum would be paid annually by Government for each school.

The pupils would be taken at six or seven years of age, and would have to cultivate small plots of exportable produce, the crops belonging to the boys and being sold for their exclusive benefit. Outside of this agricultural work, the pupils would be taught reading, writing, and handicrafts: carpentry, masonry, etc.

A system has been recommended in Belgium whereby the adult natives would be compelled to plant a given number of trees and provide for their upkeep, the crops belonging to the natives. This system is called by some people forced labour; others are of opinion that it would rapidly improve the condition of the natives.

AGRICULTURAL EDUCATION IN THE GOLD COAST.

By W. H. Patterson.

Government Entomologist, Gold Coast Colony.

[No abstract supplied by the author.]

AGRICULTURAL EDUCATION IN THE PUNJAB.

By J. H. Barnes, B.Sc., F.I.C., F.C.S.,

Principal of the Punjab Agricultural College and Agricultural Chemist to the Punjab Government.

[No abstract supplied by the author.]

[Discussion.]

The President: I would ask you, before proceeding to discuss these papers, to give your thanks to the authors—to Dr. Gough for having read Mr. Dudgeon's paper; to Dr. Manetti for reading Dr. Gioli's paper; and lastly, to Mr. Hamel Smith. These have been very interesting communications. Mr. Dudgeon discusses in detail the necessity of the establishment of an agricultural college in the tropics, and no one can speak with greater authority or larger experience. Mr. Dudgeon, as many of you are aware, was originally a planter in India. He then took up the study of tropical agriculture in Egypt, Ceylon, and the United States. He was next appointed Inspector of Agriculture in British West Africa, where he made every year tours of inspection and produced some valuable reports to the Colonial Office, and he now occupies the very important position of Consulting Agriculturist to the Government of Egypt. With regard to Dr. Gioli's paper, though I am afraid some of us were not able to follow it with that completeness we desired, owing to

our unfamiliarity with the language in which it was read, I am sure you will wish to express your great admiration of the activity of Dr. Gioli and his colleagues. His countrymen have not been very long engaged in colonial work, and they certainly have the advantage of our experience as well as our mistakes to guide them. They also have the advantage of a climate at home which enables them to do a great deal more in the way of preliminary work than we could possibly attempt in this country. All of you will join me, I know, in wishing great prosperity to the efforts which Italy is now making to establish agriculture successfully in her new African possessions. Lastly, we have heard Mr. Hamel Smith's exceedingly interesting and, I think, weighty plea for the establishment of an agricultural college in the Western Hemisphere, for which he adduces evidence not merely based upon the importance of such a college to the West Indian Islands, but goes further, and points to the importance of establishing it as a means of training the numerous young men who go out to Latin-America to engage in agricultural pursuits.

Mr. R. N. Lyne (Director, Department of Agriculture, Ceylon): Mr. President and Gentlemen—I have listened with very great interest to the papers which have been read here to-day, and more especially to what our President said in his opening address this morning, when he appeared to me to place the general outlines of the question of education in tropical agriculture in its true perspective. We are doing something in Ceylon in the matter of education in tropical agriculture, and we are approaching it from three points of view. In the first place we have to consider the training of the peasantry. This can only be done by educating the children in the schools. It is no use, in my opinion, ever attempting to alter the methods of the adult goiya, as we call him in Ceylon. The education of the children in the schools can only be effected by educating, in the first place, the school teachers, and for this purpose we have sent to one of the Agricultural Colleges of India—Poona—four selected students to take a three years' course. They are returning next year to Ceylon, and in the meantime we are getting ready with our buildings and our organization to begin upon the education of the teachers. Our object is that agriculture shall become a subject in the curriculum of the vernacular schools, just as arithmetic or history is now. The next question is the education of what we call the conductor or overseer class. As a rule in Ceylon, and also in many other tropical countries, this class of man can speak English, and it is our intention to try and graft on to our organization for the education of the school teachers the education of the conductor. Of course,

his training will have to be on a little higher level. But what is mostly occupying our minds to-day is the higher training in tropical agriculture, and that, I think, is what we understand by that term here in this country. Now I do not propose to-day to enter into any discussion, or to say anything with regard to the rival claims of the East (which in this matter of a tropical agricultural college is principally represented, I think, by Ceylon) and of the West Indies. Our President to-day in his address, as I say, really put the matter in its proper perspective, which amounted to this: We have to consider not only the interests of Ceylon, or of the West Indies, or of any other country, but the interests of the student who goes out from this country, or from Europe, and we have to decide where he is likely to get the best education in tropical agriculture; and, of course, when you have to deal with young men of tender years, you must also consider the question of health. We in Ceylon are quite content to leave the matter there, and we are quite certain that when we consider the variety of products which are grown in Ceylon, not merely in experiment stations, but by practical men running their plantations on a business footing and making money out of them, there is no country in the world with the advantages that Ceylon can offer. Then you have also to consider the matter of transport. Transport in some countries, especially for instance in Africa, is slow and laborious. In the West Indies you have the disadvantage of the islands being separated by wide seas. Now Professor Dunstan referred to Peradeniya this morning, and Peradeniya, which is the projected site of the College of Agriculture in Ceylon, is in the centre of the planting industry there. There is no plantation in Ceylon for rubber, or tea, or cocoa, or coconuts, or citronella, or anything else, which cannot be reached in one day from Peradeniya. I do not know whether you can say so much as that of any other part of the world. Mr. Hamel Smith, I think, referred to the West Indies as possessing a large and comprehensive variety of products cultivated on a plantation scale, but I do not think that the West Indies can compare with Ceylon in this respect. There is no tea there, for example, and I do not think their rubber industry, at any rate yet, has reached the practical, progressive, and successful stage which it has in the East. As far as fertility of soil goes, I do not know whether we could not quote figures to show that we in the East can produce crops equal to those of the West Indies. Now, gentlemen, I should like just to mention to you one or two points which have occurred to me in considering this question of a College of Tropical Agriculture. In Ceylon we have our plans prepared, we have our site selected,

and we are only waiting now for the requisite funds. We shall look to this country, privately and officially, to come forward and help us. We cannot do it alone in Ceylon, although we are prepared to do our share there privately and officially, and we do want those great commercial bodies and companies which are built up on the products of the East to do their share here. But I want to-day just to point out to you a few difficulties which have occurred to me in thinking of this question, because I should be very sorry to see a college established either in Ceylon or anywhere else, and failing to carry out whatever it was proposed to carry out. Now in a college of agriculture in the United Kingdom or in any of the Dominions a student can go in, and he can come out a competent agriculturist. He can take up dairying, stock-farming, wheat growing, oats, barley, roots—it does not matter what it is, he comes out fully equipped. He can go to the Dominions, to Australia, or New Zealand, or Canada, or elsewhere, and he is immediately at home on the land. Now as far as botany and entomology and chemistry go, the education which the student receives in England will be the same in its general principles—especially as regards chemistry—as he will require in the tropics, but when we get on to crops and practical agriculture we enter a completely new field. What strikes me in thinking about this idea of tropical colleges is that we are treading on completely unknown ground; we do not know yet how we are going to grapple with this tremendous subject of tropical agriculture. As I say, a student in England can become a fully equipped farmer, but there is no man living who can say that he is a fully equipped tropical agriculturist, because he must be a specialist—it may be in sugar, in tobacco, in tea, in rubber, or in something else, and we cannot staff our college with specialists—it would be impossible. My time is up, gentlemen, but I am very glad to have had sufficient time to bring that point before you. I should just like to add this one word further—that not only do we require specialists for the various crops, but in the case of certain crops like sugar (and we are coming to the same thing in regard to rubber) we require specialists for the field and specialists for the factory also. I have brought this difficulty before you in order that those whose minds are now engaged on this important question may not lose sight of this great difficulty which I foresee.

Professor Ainsworth-Davis (Principal, Royal Agricultural College, Cirencester): Mr. President and Gentlemen—I should like all those present who have not an intimate knowledge of the attention which is being given in the agricultural colleges of this country to the matters with which we are here

concerned to realize that we are very much in earnest with regard to our wish and desire to do our best for tropical agriculture. We realize very strongly in Great Britain that for various reasons, political and otherwise, large sums of money are being invested in tropical agriculture, and the different colonies in the tropics are simply touting for men who will be able to serve them. I can speak, of course, more particularly of my own college, the Royal Agricultural College at Cirencester, which is the pioneer college, and which, having no local ties, is more free perhaps for this Imperial work than some of the others. I think, gentlemen, it is important—very important—to understand that the ordinary training of a college in agriculture, provided it embodies really sound scientific work, is able to turn out very satisfactory agriculturists indeed. I can only tell you that a number of our own students, who have not had any specialized training in tropical agriculture, have done good work in the various colonies that engage in tropical agriculture, one being Mr. Kelway Bamber, who is known, I believe, pretty intimately to Mr. Lyne; also Mr. James Mollison, formerly Inspector-General of Agriculture for India; Sir J. Muir Mackenzie, K.C.S.I., who had an important post in the Bombay Presidency (he was on the Council of the Governor); Mr. Despeissis, who did work in the tropical parts of Australia; Mr. Neville, who was in the Sudan, and so on. But, in spite of that, it is clearly desirable that there should be a little tincture of tropical work in the preliminary training, though I very much oppose and resist any attempt to give training with a "bias"—that horrid word which has been introduced by our Board of Education with regard to "rural bias," and so forth. I submit, gentlemen, that training in tropical entomology is the same as training in any other entomology. There is only one entomology known to me, and I speak as a professional zoologist. When you give a "tropical bias," you simply give tropical illustrations and so forth, and I fancy that a man who has been properly trained in this country in any branch of science is competent to take up tropical work in that science.

But I really must traverse one or two points in the paper of Mr. Dudgeon. The chief thing to which I object there is that it is a bit too cut-and-dried, and I do not think that we have come to the cut-and-dried stage yet. I do not know that a diploma should be an absolutely essential preliminary to going to a tropical college, because the training will differ according to the aim in view. A man may wish to be an expert planter, or an administrator, or he may wish to go in for research; and it does not follow that the best way of pursuing,

say, research is on the back of a diploma. In my opinion the matter should be left exceedingly elastic.

There is only one other word I should like to add, namely, that it seems to me that, instead of debating whether it is better to go to the East or to go to the West, we should have as many colleges as we want—as many as are indicated as necessary. I do not know that all of them need be so extremely expensive. Now is an opportune moment, because there are many fortunate people, I understand, who will now only have to pay 1s. 3d. income tax instead of 1s. 4d., and numbers of these will no doubt devote the other penny to tropical agriculture. I also trust, gentlemen, that we shall find in the development of tropical agriculture one other powerful means of securing peace, and as a zoologist I cannot but recall the enormously good work done by some of the zoological marine stations, particularly that at Naples. I am quite sure that the fact of students of different nationalities having worked side by side in the laboratories there has done much to promote good feeling between the various countries, and I hope that the different nations will be able similarly to co-operate in regard to tropical agriculture. I can only assure you, Sir, that the College I represent is extremely anxious to continue in future the training, and the better training, of British students in order to qualify them to take up work of this kind.

Professor P. Carmody (Director, Department of Agriculture, Trinidad): Mr. President and Gentlemen—I think I will begin at once by conceding that the East may have a college of its own, and I will mention to you a few reasons why I think we should have a second college in the West Indies. In Trinidad during the last twenty years we have been taking very active steps in agricultural education, and have gone far to establish the work that a college will do. I think we have gone even farther than Mr. Lyne, who says that he has all his plans prepared and a site chosen for his college. We have the building already erected. It was not specially erected for a college, but it is large enough for the purpose. We have around it an estate, belonging to the Government, of 3,000 or 4,000 acres of land, on which sugar and various small crops are grown, partly for experiment, and partly by peasant proprietors. We have sites for dwellings quite close to the building which we intend to have occupied as a college. We have a cocoa estate belonging to the Government, on which we have at the present time something like 90,000 trees, and on that estate practical education has been given for some three or four years to young men in the colony who wish to become overseers or managers of estates. I

think, therefore, that having these advantages, the estimate of cost which Mr. Hamel Smith has quoted with regard to Ceylon will be very much less in our case. As a matter of fact, I think that if the salaries of two research workers be provided, we shall have enough to go on with for the next five years. As to the question of education, I may say that in 1900 we introduced agricultural instruction into the primary schools of the colony. In two years or thereabouts we trained 200 teachers, and in about another year or so agriculture was made a compulsory subject for children of a certain age in all schools. School gardens are attached to the schools, in which a certain amount of agricultural instruction and practice is given to the elder students of the schools. In association with all this we have school shows once a year, at which prizes are given for the best vegetables, or whatever it may be, that are grown on these school plots. We have also provided a system of home reading courses, by which persons who are already employed in agriculture, on estates or otherwise, may receive instruction by correspondence to supplement the knowledge which they obtain in practice every day. That is a three years' course, and it is working out very satisfactorily. About ten years ago we introduced higher agricultural education into the colleges, and some sixty students are examined every year by the Cambridge local authorities in agriculture. The examination papers are purposely set so as to be suitable for tropical students. You will see, then, that in Trinidad we have done a great deal of the work that an agricultural college is expected to do, and I sincerely hope that within the next five years we shall be provided with sufficient funds to add the two scientific men whom we would employ solely on research. There is one point which was referred to by Mr. Lyne to-day to which I would like particularly to draw attention, and that is this. He said he was of opinion that it was impossible to make any improvement in the methods of the adult labourer. Well, I think in the West Indies we have accomplished an improvement in two or three of the islands. It was started many years ago in Jamaica and in Grenada, where a scheme of competition amongst peasant proprietors was established, and prizes given to those who were most successful in their work. In Trinidad we adopted that system about three years ago, and I can assure Mr. Lyne that the work has been most successful. In the first year's competition (which was unfortunately limited to two districts, as we have not more than two agricultural instructors) there were about 300 competitors, and instruction was given on the holdings of each competitor by the instructors, who were the best cocoa planters we could obtain on the island. They go there

and give instruction as to how the work is to be done, and they, in conjunction with one or two others, judge the work at the end of the year. The results have been so very satisfactory that it is our intention, as soon as we are able to provide other instructors, to extend that system to the whole of the island. The improvement in cocoa cultivation and cocoa estate sanitation since the introduction of this prize system has been very marked and very gratifying to the Board of Agriculture, which provides the prizes.

M. E. Leplae (Director-General of Agriculture, Colonial Office, Belgium): Mr. President and Gentlemen—I wish to say that my Department has read with great interest all that has been said by the honourable President, and all that has been written in *Tropical Life* on the necessity of establishing agricultural colleges in the tropics. This subject is especially interesting to Belgians, as we are new-comers in the field of tropical agriculture, and have to learn everything in that respect from the older colonies. We sincerely regret that there is not at present for students a single high school of agriculture in the tropics—a really astonishing fact considering that of the total value of exports of the tropical colonies, 75 per cent., according to recent statistics, is derived from agriculture. There is a very small number of high schools of tropical agriculture, but they are all in Europe. A very similar situation prevailed some years ago with regard to the agriculture of sub-tropical countries, but there are now excellent schools in several of the French colonies, in the Southern States of America, in South Africa, in Egypt, in India, I believe, and in some other countries. How is it that the teaching of tropical agriculture in the tropics is still non-existent? First of all, the climate is a serious drawback, as a tropical school will assume a great responsibility as to the health of the students. Special care will have to be taken, and special accommodation and costly buildings will be needed. Then the teaching staff, if it is to be really efficient, will be very expensive. The first cost, and the upkeep, of the scientific equipment will be very high, and a consequence of all these expenses will be that the students will have to pay very high fees for board and tuition. However, a school of tropical agriculture—established in the tropics and in touch with up-to-date tropical plantations—would offer such advantages from a practical point of view that the high expense should be considered only with the purpose of finding a way to reduce it as much as possible. I beg to submit to this Congress a scheme that was discussed four years ago, when I was travelling in the Dutch colony of Java with Heer Lovink, the Director of Agriculture there. My idea was to send a good

number of our Belgian Congo State agriculturists to Java, to let them see and judge of that established colony, where the tropical plantations are quite up to date. It is still possible that an agricultural school may be established in Java. Our scheme ran as follows: First, the students would have to graduate in a European school of agriculture, and acquire the necessary knowledge in natural science and general agriculture. Secondly, this would enable the school of tropical agriculture to have a programme of only one year's education. Its teaching would be almost entirely practical, and would be given by specialists. These specialists would be selected from amongst men thoroughly acquainted with agricultural practice by several years of work either on tropical stations, cattle-breeding stations, or in laboratories for the study of tropical agriculture. Special value would be set on practical lectures delivered by managers of large plantations and factories. For instance, the cultivation of the sugar cane should be shown on a big sugar estate, and the cultivation of tobacco on a large tobacco plantation. If the course of study is reduced to one year only, it means a great saving of money, both for the school and for the scholars. Now where is that school of tropical agriculture to be established—in the West or in the East? I leave this question for the consideration of more competent members of the Congress. Ceylon is, of course, a splendid colony, but I venture to express my opinion that two schools, one in the East and one in the West, would meet the requirements better than a single school—the natural conditions being quite different. I should add that if there is a school established either in the East or in the West the Belgian Congo will certainly wish to send some students to learn from the experience of the older colonies.

M. Leplae then described briefly the scheme of elementary agricultural schools for natives in the Congo, referred to in his paper (p. 69).

Mr. H. A. Tempany (Superintendent of Agriculture, Leeward Islands): Mr. President and Gentlemen—The scheme of education carried out in the Leeward Islands is to a large extent outlined in Dr. Watts's paper. The system of cadets he describes provides for the taking in and training of youths between the ages of 15 and 16 at the secondary schools in the colony. They then proceed to a botanical institution, where they receive training varying in length from one to two years. I would like to say, as an addition, that during the last four years we have found this system to give exceedingly good results. Of course we have been able to take only a limited number of boys over a relatively wide range of choice, but at the same time our success has been quite

remarkable considering the limited outlook which young men and boys naturally have in small West Indian islands. They are sent to experimental stations for a certain time and the experiments carried on at these stations illustrate on a small scale what we are aiming at on a larger scale. As regards elementary teaching of adults in tropical agriculture, I should like to touch on one point to which Mr. Lyne drew attention. I should like emphatically to confirm what Professor Carmody said with regard to the value of prize competitions. In Dominica we have found, as Professor Carmody has pointed out with regard to Jamaica and Grenada—and it is now being done by Trinidad also—that we have been able by means of prize competitions very greatly to improve the standard of cocoa cultivation amongst the peasants of that island. I should also like to point out that during the last ten years a very large colony of peasant Sea Island cotton planters has sprung up. The chief characteristic of these islanders has been that they are exceedingly careless agriculturists, but owing to a large extent to the prize competitions which we have instituted, there has been a great improvement, and they have largely adopted those improved methods of cultivation which are essential to the successful production of Sea Island cotton, and it is surprising to see the exceedingly well cultivated plots of cotton in those districts which were formerly so neglected. In conclusion, I should like to make one remark in relation to the question of a tropical agricultural college. Wherever the tropical agricultural college may be located, and no matter whether there may be one or two, we can never hope to realize within any one locality the broad range of conditions which prevail throughout the tropics, but at the same time the men who go there and work as students will realize what after all is the main thing, the atmosphere permeating the whole of the tropics, and the college will provide a focus and a centre for those tropical countries where research work is being done, and will serve as a stimulus and a guide to many of us who are attempting to do, in the intervals of other occupations, a certain amount of purely scientific work under our isolated conditions.

The PRESIDENT: Gentlemen—I am afraid we must now bring this discussion to a close with a vote of thanks to the readers of papers, though I am sure there are many here who would like to make further contributions to the very interesting discussion we have had this afternoon. The subject is bound to come up at other meetings in other connections, and I will only say now that the question of an Imperial agricultural college in the tropics has since the opening of this Congress assumed almost an international character. As

M. Leplae said this afternoon, if an Imperial college is established, whether in the East or in the West, Belgium, and I believe France and Germany also, will desire to send students to it. The details of the project have to be thought out before it can take a definite shape. The chief business of such a college should be to provide instruction and information on general lines, and on this point I am in entire agreement with what M. Leplae has said. I hope before this Congress is concluded some of us, at all events, will have made up our minds on one or two fundamental points, and to this end the papers to which we have listened this afternoon will considerably contribute.

TUESDAY, JUNE 23.—AFTERNOON SESSION,

4.30 P.M.

British Cotton Cultivation.

Chairman: THE EARL OF DERBY, G.C.V.O., *President of the British Cotton Growing Association.*

THE CHAIRMAN: Gentlemen—As you have been informed it is as President of the British Cotton Growing Association that I have had the honour of being asked to take the Chair to-day for Mr. Hutton, the Chairman of that Association, and nothing could have given me greater pleasure than to preside at a meeting at which a past master of the art of cotton growing is to read a paper which I am sure will interest all of you.

I am afraid that to a certain extent the British Cotton Growing Association is a somewhat selfish concern, as it exists for the purpose of growing cotton in British territory, and principally for British use. But during the various operations that have gone on in the course of the past few years we have gained a vast amount of experience—I may add at a considerable cost—and that experience, although it was primarily intended for the use of our own nation, is only too willingly placed at the disposal of the whole world, in the hope that every nation may, in the territories belonging to it, grow cotton good enough and ample enough for its requirements. I have the greatest possible pleasure in calling upon Mr. Hutton to read his paper—a paper which he has written on behalf of the British Cotton Growing Association, an Association which has the approval and the full support of His Majesty's Government.

THE WORK OF THE BRITISH COTTON GROWING ASSOCIATION.

By J. Arthur Hutton,
Chairman of the Association.

[Abstract.]

The British Cotton Growing Association was formed in 1902 with the object of establishing and extending the growth of cotton in the British Empire, and to relieve as far as possible the dangerous position of the Lancashire cotton industry, owing to the fact that it was dependent on the United States for the bulk of its supplies of the raw material. The Association was originally constituted in June, 1902, as a voluntary body with a guarantee fund of £50,000 which was subsequently increased to £100,000. In August, 1904, it was reconstituted on a permanent basis as a company with a Royal Charter, the capital being £500,000. Sir Alfred Jones, K.C.M.G., was the first President and on his death Lord Derby took his place.

It was stipulated that no dividends should be paid for seven years, and the work is still conducted on a semi-philanthropic basis. The Association is representative of capital and labour and of all the various branches of the cotton trade and the allied industries. The Association works in hearty co-operation with the Government and the colonial authorities, and conferences are held periodically at the Colonial Office under the chairmanship of the Under-Secretary of State. The Association is also in constant communication with the colonial authorities on all the various questions connected with cotton growing and is able to offer valuable and disinterested advice. The Association receives a grant of £10,000 per annum from Imperial Funds to be spent upon experimental work.

The work consisted originally of inquiries into the possibilities of the various colonies, and a number of experts were sent out to different parts of the Empire. Practical experiments were also carried out in many colonies. The Association now concentrates its work on those parts of the Empire which offer the best possibilities of large results in the immediate future, as follows:—

1. India;
2. The West Indies;
3. West Africa;
4. Uganda and Nyasaland;
5. The Anglo-Egyptian Sudan.

India.—The Association actually spent over £3,000 in India, viz., half of the cost of some practical experiments with tree or perennial cotton, which unfortunately were not successful. Its principal work as far as India is concerned now consists of reporting on samples and advising on technical points in connection with cotton, but in 1904 representations were made to the Government of India which have led to important results. The principal steps then recommended by the Association were as follows:—

(*a*) The establishment of farms for experimental work and raising supplies of pure seed.

(*b*) The strengthening of the Agricultural Department and the establishment of special branches for dealing with cotton.

(*c*) The organization of agricultural banks.

(*d*) A botanical and commercial survey of the indigenous varieties in the various districts.

The Association subsequently offered to establish buying and ginning stations in Sind in co-operation with the Government, but this offer was not accepted.

West Indies.—The Association has made several grants to the West Indies for payment of experts, erection of machinery, etc., and works in co-operation with the Imperial Department of Agriculture. It superintends the sale of the cotton, and also finances and insures shipments, and the planter who consigns his cotton to the Association can depend on obtaining the best possible price. Sea Island cotton of the very highest class is grown and the crop amounts to about 6,000 bales per annum, which is all that is required at present.

West Africa.—As there were no cotton experts on the staffs of the Agricultural Departments, the Association originally carried on the scientific as well as the commercial work, and its experiments with exotic seed were very successful. The scientific work is now carried on by the governments, and the Association purchases the cotton from the natives with the co-operation of the merchants. The Association has also erected large baling and ginning factories in various parts of Africa. Cotton growing in West Africa is carried on solely as a native industry, and the Association endeavours to get into as close touch as possible with the producer and so ensures that he receives the highest possible price. The Association has absolute control over the supply of seed for sowing, and in consequence of selection by it Lagos cotton is to-day the most regular and even in quality of any cotton produced in any part of the world. West African cotton can, however, be improved, as it is rather short and rough and gives only about 27 per cent. of lint, but it is remarkably strong. It would be an advantage if a variety could be established of a rather longer,

whiter, and silkier character and which would give at least 30 per cent. of lint.

The great difficulty in West Africa was transport, and largely in consequence of representations from the Association the Lagos Railway was extended to the Niger and a line constructed from Baro to Kano.

The experiments in Gambia and Sierra Leone were given up and only poor results were obtained in the Gold Coast Colony. The best results have been obtained in Nigeria, where the crop amounts to 16,000 bales per annum. The cotton is worth about ¼d. to ½d. per pound more than Middling American. The Association has established a standard bale of 400 lb., and its ginning and baling factories are probably the best equipped saw-ginning factories in the world.

Uganda.—Better results have been obtained in Uganda than in any other colony; the Association has no branches there, but works through its agents, the British East Africa Corporation. Various varieties of seed were indiscriminately distributed and the cotton was much mixed and also liable to stains. There was no properly equipped Agricultural Department, and in consequence of representations from the Association experts were appointed and the quality was much improved. The Association assists in financing and selling the crop and also supplies machinery, etc., on easy terms of payment. It is constantly in communication with the Colonial Office with reference to various points in connection with cotton, such as transport facilities, cotton rules, varieties of cotton, buying prices, etc.

The production in Uganda has increased from 500 bales in 1906, to 29,000 bales in 1912. In 1913, owing to a misunderstanding about the issue of seed, the crop was only 26,000 bales. The quality is rather better than Texas and fetches from ½d. to 1½d. per pound over Middling American.

Cotton growing in Uganda also is solely a native industry, and there are no plantations owned and managed by Europeans.

Nyasaland.—The cotton industry in Nyasaland commenced on plantations belonging to Europeans, who received large financial assistance from the Association. Transport difficulties were very serious, and the Association and its friends assisted in raising the necessary capital for the railway from the Zambesi to Port Herald. In 1910 the Association established its own branches, and since then cotton growing as a native industry has rapidly advanced. The crop in 1912 amounted to 6,800 bales. The cotton, though not long in staple, is very fine and silky, and is worth from 1d. to 2½d. per pound over Midding American. Nyasaland seed has given good results in other colonies.

The Association also co-operates with the North Charterland Exploration Company in endeavouring to establish cotton growing in North-eastern Rhodesia.

Anglo-Egyptian Sudan.—In 1912 a deputation from the Association visited the Anglo-Egyptian Sudan and reported most favourably on the possibilities of that country, and particularly with reference to the Gezira Plain, which in their opinion offered "one of the finest cotton propositions in the world." In their report they stated that there seemed to be no reason why in the next few years there should not be raised annually 50,000 bales or more of really high-class Egyptian cotton, with the prospect of the production increasing to 250,000 bales within ten to fifteen years, and with further possibilities later on of a production of 1,000,000 bales or more.

The Government experiments at Tayiba were eminently successful, and the Association organized a deputation to Mr. Asquith on January 23, 1913, when it was urged that the Imperial Government should guarantee the interest on a loan of £3,000,000 for the construction of irrigation and other works. The Government promptly agreed to the Association's request. Lord Kitchener is taking the deepest interest in the question.

Conclusion.—The Association has spent £170,000 on inquiries and experimental work, and has aroused the interest of the whole Empire in the possibilities of cotton growing, and it has started one of the greatest Imperial movements of modern times which will go on for ever. In 1903 the production of cotton in new fields in the Empire amounted to only 1,900 bales worth £29,000. In 1913, 76,800 bales were produced worth £1,170,100. Since the commencement of the Association's work in 1902, 360,640 bales have been grown to the value of £5,195,100. As far as is compatible with the objects for which the Association was formed, the work is run on business lines, as it is essential that it should pay its way. It would be a misfortune for the Empire if the Association had to suspend or curtail the work in any way.

The business has grown very rapidly, and in 1913, 46,466 bales, worth £661,277, passed through the hands of the Association, and at one time over £250,000 was advanced against cotton crops, machinery, etc. The Association assists planters and others by financing, insuring, and selling cotton and seed, and supplies machinery, etc., on easy terms of repayment. The Association also assists Agricultural Departments by reporting and advising on samples of new growths, and constantly gives advice to planters and others on various matters connected with cotton growing. In 1913, 62,113 letters were received and despatched—an average of 207 per working day. There is a large and efficient staff in Manchester and Africa,

and the work, though run on semi-philanthropic lines, is organized on a sound commercial basis.

The Association has also assisted in the formation of other cotton growing and buying companies, and together with its own capital of £500,000 the total amount raised for cotton growing under its auspices amounts to £1,125,000. The work, however, continues to grow rapidly, and the provision of large sums of additional capital is a very pressing one.

The Association owes great thanks to the assistance received from the Government, no matter which party was in power, and also to the officials both at the Colonial Office and in the colonies, and more particularly to Mr. Harcourt and Lord Emmott. It has also received valuable assistance and advice from Professor Dunstan and the staff of the Imperial Institute.

[Discussion.]

The Chairman: I will ask the President, Professor Dunstan, to read some remarks which Lord Emmott would have made had it been possible for him to have been present.

The President: I have been asked by Mr. Harcourt, the Secretary of State for the Colonies, and by the Duke of Marlborough and Lord Emmott to present their apologies and their regret that important Parliamentary engagements prevent their attendance this afternoon at this meeting. Lord Emmott has sent a written statement of some remarks which he would have made had he been present, and I propose now to read this.

Lord Emmott: One hundred and thirty years ago a consignment of 1,200 lb. of cotton purporting to come from the United States of America was seized by the Customs Authorities of this country because they did not believe so much cotton could have been grown in the States at that time, whereas if it were West Indian cotton it ought not to have come in a foreign vessel. That story illustrates how great a business may arise from small beginnings. The United States is to-day far the largest grower of cotton in the world. Once the cultivation was started on a sound basis it rapidly forged ahead. It took them a long time, however, to grow their first 100,000 bales, and we who are interested in increasing the supply of cotton for the world must not grow weary because every effort in a new district is not crowned with immediate success.

The various difficulties in the way of the pioneer have been dealt with in the course of Mr. Hutton's admirable paper. Quite apart from the vital question of transport there are

difficulties of soil and rainfall. Lengthy and careful experiment under the supervision of experts is necessary to find the type of cotton best suited to any given area. Experts do not grow on every bush, and we often experience a difficulty in finding enough for our needs.

Then there are the difficulties connected with human elements. In most, if not all of tropical Africa, I think cotton cultivation must be voluntarily conducted by the black man, and not in plantations controlled by whites.

The native willing to grow it rather than other crops must be found in the first place. In the second place this native needs advice and supervision in order that he may learn how best to fight the dangers of climatic conditions and the perils of insect pests.

The mysteries of cotton futures in the markets of the world are unknown to him. What he does care about is to feel sure of a price which does not fluctuate much and which pays him satisfactorily. Just as we need to remember the native wants a regular and a paying price, so he needs to be taught that the spinner of cotton requires regularity in colour and staple.

So, apart from transport, there are the questions of the provision of experts, of the conduct of experiments, and of producing the desired psychological effects on the mind of the natives. These questions are partly material and partly moral. For these purposes I think it will be agreed that a Government Department and a partly philanthropic and partly commercial body like the British Cotton Growing Association acting in cordial co-operation form the best combination.

Of course, they must work cordially together, or, as I am sure Mr. Hutton will agree, the sparks would soon fly. I found very cordial relations existing between the Colonial Office and the British Cotton Growing Association when I went to the Colonial Office in 1911, and I am happy to say those cordial relations continue unabated to the present hour.

I am very glad to be able to congratulate the British Cotton Growing Association on the satisfactory figures they have put before us to-day, and I need not say how much the Association owes to the energy and enthusiasm displayed by Mr. Hutton in the work. No doubt there must come before long modifications in the co-partnership (if I may so call it) existing between the Colonial Office and the British Cotton Growing Association; but whatever may happen about our financial relations, it will be necessary and desirable for both of us to work together for many years to come in support of the extension of the growth of cotton in the Empire. Whether I happen to be in the Government or out of it, that will certainly be my view.

The British Cotton Growing Association has done excellent work in the past, and will, I hope, do more excellent work in a larger field in the future. Circumstances are in its favour. There is almost an illimitable demand for cotton, and there seems no probability of an illimitable growth of cotton. Cocoa, coffee, rubber and other commodities are quite as attractive to the producer.

I am inclined to think, therefore, that cotton will on the whole remain relatively high in price. From the point of view of the British Cotton Growing Association I hope so. For, successful as it has been, I fear the prices of 1898, when Middling American averaged only 3·31d., per lb., would make the continuance of its operations difficult if not impossible.

In the few remarks I have made on Mr. Hutton's paper I have spoken of the desirability of increasing the growth of cotton in the British Empire. I do not forget this is an International Congress of Tropical Agriculture. It only remains for me to say in conclusion that we do not take a narrow or particularist view of this question. We shall be only too delighted to see an increase in the growth of cotton in other Empires than ours, and Mr. Hutton has shown how ready the British Cotton Growing Association is to give to the world the benefit of the knowledge and experience it has gained during the last decade.

On the motion of the President, a vote of thanks was unanimously accorded to Lord Derby and to Mr. Hutton.

TUESDAY, JUNE 23.

Dinner and Reception by His Majesty's Government.

His Majesty's Government entertained the Government Delegates, the principal Representatives and Officers of the Congress, and other guests at dinner at the Imperial Institute. The Right Hon. Lord Emmott, G.C.M.G., Under-Secretary of State for the Colonies, presided, and there were also present: The Netherlands Minister, the Belgian Minister, Professor Dunstan (President of the Congress), the Right Hon. Sir George Reid, Monsieur Leplae (Belgium), the Hon. Charles G. Murray (St. Vincent), Sir Herbert Praed, Sir Frank Swettenham, Sir James Wilson, Sir Sydney Olivier, Sir H. Hesketh Bell (Leeward Islands), Sir Hugh Clifford (Gold Coast), Sir Horace Plunkett, Sir Stanley Bois, Sir Edward Rosling, Mr. H. N. Ridley, Captain Muirhead Collins, Mr. W. A. Graham (Siam), Mr. A. C. Hollis (Sierra Leone), Mr. J. A. C. Tilley (Foreign Office), Count Bentinck (German Embassy), Dr. Heim (France), Dr. Bücher (Germany), Professor Warburg (Germany), Monsieur de Fedtschenko (Russia), Dr. C. J. J. van Hall (Java), Monsieur V. Mosseri (Egypt), Commander Coutinho (Portugal), Dr. C. A. Barber (India), Professor P. Carmody (Trinidad), Mr. R. N. Lyne (Ceylon), Mr. W. H. Johnson (Nigeria), Mr. J. S. J. McCall (Nyasaland), the Hon. C. H. Tufton (Foreign Office), Mr. Faithful Begg (London Chamber of Commerce), Mr. J. A. Hutton (British Cotton Growing Association), Mr. C. C. McLeod (London Jute Association), Mr. George Miller, Mr. J. McEwan (Rubber Growers' Association), Mr. A. Lampard, Mr. T. L. Gilmour, Dr. H. M. Fernando (Ceylon), Dr. W. A. de Silva (Ceylon), Mr. G. A. I. Bosanquet, Dr. T. A. Henry, Mr. Harold Brown, the Hon. T. L. McClintock Bunbury (Imperial Institute), and Mr. Walford Selby (Foreign Office).

The toasts were "The King" and "The International

Congress of Tropical Agriculture," proposed by the Chairman, who in the name of His Majesty's Government welcomed the Delegates, and referred to the importance which the Government attached to the deliberations of the Congress, and the interest with which he had followed that morning the opening address delivered by the President, Professor Dunstan, with whose name he desired to associate the toast of the International Congress of Tropical Agriculture.

Professor DUNSTAN, in reply, said that on behalf of the Delegates, Representatives, Officers and Members of the Congress, he wished to thank Lord Emmott, and through him His Majesty's Government, not only for their generous hospitality, but also for the assistance which the Government, and especially the Secretary and Under-Secretary of State for the Colonies, had afforded to the organization of the meeting. The success of the London Congress was already assured, and never before had there been assembled a more numerous or more distinguished representation of all the countries concerned, or a larger number of important communications. As he had that day occupied so much of their time, he would say no more except to make an announcement which he was sure would meet with as much enthusiasm as that with which they had just received the toast of "The King." His Majesty, who was the Patron of the Congress, had graciously sent the following message, which arrived after the conclusion of the opening meeting that morning:—

"It is with much pleasure that I welcome to London the Delegates of the International Congress of Tropical Agriculture. The importance of their deliberations, and the number and variety of subjects to be discussed, are of especial interest to me. I trust that their discussions will contribute to the advancement of agriculture in the tropics."

GEORGE R.I.

He was sure that they would desire that a reply should be sent conveying the respectful thanks of the Congress to His Majesty the King for his gracious recognition of the importance of their work.

After the Dinner a Reception was held by His Majesty's Government in the Central Hall and Galleries of the Imperial

Institute, for which about 2,000 invitations were issued, including all the Delegates, Representatives and Members of the Congress. The new Ceylon Pavilion was opened and the West Quadrangle was illuminated. The band of the Royal Artillery played in the Garden and in the Galleries. The guests were received on behalf of His Majesty's Government by the Secretary of State for the Colonies (the Right Hon. Lewis Harcourt, M.P.) and Mrs. Harcourt.

WEDNESDAY, JUNE 24.—MORNING SESSION,

10.30 A.M.

Sanitation and Hygiene on Tropical Estates.

Chairman: LIEUTENANT-COLONEL SIR RONALD ROSS, K.C.B., F.R.S., *Professor of Tropical Sanitation, Liverpool University.*

The PRESIDENT: Gentlemen—Before we proceed to the business of this morning, I should like to tell you that yesterday, after the morning session had closed, we had the great gratification of receiving a special message from His Majesty the King. The King, as you are aware, is the Patron of our Congress, and he has sent us this message:—

"It is with much pleasure that I welcome to London the Delegates of the International Congress of Tropical Agriculture. The importance of their deliberations, and the number and variety of the subjects to be discussed, are of especial interest to me. I trust that their discussions will contribute to the advancement of agriculture in the tropics."

GEORGE R.I.

On your behalf, I sent this reply to His Majesty's message:—

"The Third International Congress of Tropical Agriculture has received with great pleasure the gracious message from the King, and begs respectfully to thank His Majesty for his kind words of appreciation and encouragement of the work of the Congress." (Applause.)

At this morning's meeting we have an important discussion to deal with, and Sir Ronald Ross has kindly undertaken to preside. Sir Ronald Ross needs no introduction to an audience composed of workers in the tropics, and the Con-

gress is exceedingly obliged to him for having undertaken to preside over this discussion.

The CHAIRMAN: Gentlemen—We have to get through a large amount of work this morning, and I think we had better begin at once by my calling upon Mr. Evans to read the paper prepared by Dr. Sansom and himself on "Tropical Hygiene and Plantation Work in the Federated Malay States." Discussion will follow the reading of the paper, and I hope that many of you will express your views on this very important matter.

NOTES ON TROPICAL HYGIENE AND PLANTATION WORK IN THE FEDERATED MALAY STATES.

By C. L. SANSOM,

Principal Medical Officer, Federated Malay States,

AND

F. D. EVANS,

Executive Engineer, Malaria Advisory Board, Federated Malay States.

[ABSTRACT.]

It is not proposed to discuss at length all the problems of hygiene and preventive medicine which arise in connection with tropical plantation work, but to mention briefly the most interesting and important experiences and general conclusions arrived at in the Federated Malay States, and in particular to describe the anti-malarial work which is being carried out there by the Government.

The labour force for agricultural purposes is mainly recruited from Southern India under a system of free immigration, and the coolies are at liberty to move as they wish. Under a labour enactment employers are compelled to provide proper housing, water supplies, medical attendance, hospital accommodation, and other necessaries to their labour forces, and the good health of labour is therefore a matter of great financial importance to employers. Unhealthy estates are put to greater expense in order to obtain labour, pay higher wages, higher medical administration charges, and get less work from their forces than healthy estates.

The principal diseases which attack labour forces in the tropics are ankylostomiasis, cholera, dysentery, malaria, and

small-pox. Particular care and attention to drinking water and general sanitation will do much towards keeping a labour force free from ankylostomiasis, cholera, dysentery, and small-pox, and special measures are available to combat malaria. The health of a labour force is further greatly improved by attention to its food.

To reduce the risks of the introduction of infectious diseases, all Indian immigrants are detained for seven days at the port of their arrival, which added to the period spent on board ship is sufficient to allow of the detection of such diseases. Measures directed against malaria had been carried out by the Government for some years past, but in 1911 a Malaria Advisory Board was appointed to advise with regard to, and to control, anti-malarial measures. A comprehensive scheme for the eradication of anopheline mosquitoes in Kuala Lumpur (the Federal capital) was rapidly carried out, with the most satisfactory results, and similar measures have been adopted on many malarious estates. The executive officers of the Board not only supervise public works, but also assist private authorities in the execution of anti-malarial measures. A demonstration scheme to reduce malaria is now in progress on an estate in Negri Sembilan. Malaria is one of the greatest scourges of the tropics, but it has been demonstrated that it can be economically checked by radical measures.

[Discussion.]

Le Professeur Dr. Silva Telles (Lisbon) fait un résumé des mesures de prophylaxis mises en pratique dans les colonies portugaises pendant les dix dernières années. Il montre l'influence scientifique de l'Ecole de Médecine Tropicale de Lisbonne dans cette transformation sanitaire. Le programme des études et des travaux de l'Ecole portugaise est à peu près celui des Ecoles de Médecine Tropicale de Londres et Liverpool.

La plus ancienne des écoles de médecine dans les colonies des pays européens a été organisée par les portugais à Nova-Goa. Elle a près d'un siècle d'existence. Beaucoup de ses élèves se sont repandus aux Indes anglaises et en Afrique orientale. Ils ont contribué largement pour faire comprendre aux indigènes les bénéfices d'une police sanitaire et des règles hygiéniques.

Dans les colonies portugaises il y a des observatoires météorologiques et des stations de météorologie assez bien fournis d'instruments. Ils auxilient efficacement les services d'hygiène et de colonisation. Les observatoires de Loanda et de Lourenço-Marques sont assez renommés par leurs travaux.

Les services de colonisation ont été organisés dernièrement. L'enquête des régions colonisables, où la fixation ethnique des européens est probable grâce aux altitudes considérables de ces régions (1,400 m. à 2,000 m.), mérite toute l'attention du Gouvernement portugais. Il y a à present de bons laboratoires de bactériologie et parasitologie dans presque toutes les colonies. Ils sont dirigés par les anciens élèves de l'Ecole de Médecine Tropicale de Lisbonne. Quelques-uns de ces jeunes médecins ont déjà d'excellents travaux sur la maladie du sommeil, la peste bubonique, le leishmaniosis, etc. L'influence de ces laboratoires est considérable parce qu'ils dirigent aussi les services de désinfection et de l'assistance sanitaire aux indigènes. Dans ces laboratoires à Loanda, à Lourenço Marques, à Nova-Goa, on travaille beaucoup sur la maladie du sommeil, la peste bubonique, et sur presque tous les fléaux qui ravagent de temps en temps quelques peuplades.

L'assistance médicale aux indigènes et aux européens pauvres est établie depuis longtemps. Dans toutes les colonies il y a des hôpitaux, des infirmeries, des ambulances, des consultations gratuites. Le service de la vaccination, malgré la difficulté de faire comprendre son utilité aux indigènes, donne de bons résultats. Jusque dans les plus lointaines colonies, en Timor, la vaccination est faite régulièrement. Il y a même des gens qui se révaccinent sans repugnance et sans peur. La Société de Géographie de Lisbonne, dont les travaux sur toutes les questions coloniales sont très remarquables, est en train d'envoyer une mission médicale en Angola pour le service de la vaccination dans la région traversée par le chemin de fer Lobito-Katanga.

Aux indigènes qui ne peuvent pas acheter des médicaments, ceux-ci sont distribués *gratis*. Les travailleurs agricoles, soit qu'ils travaillent dans les propriétés de l'Etat, soit dans les propriétés particulières, ont le droit de recevoir gratuitement des médicaments.

Plusieurs missions scientifiques ont été envoyées par le Gouvernement portugais pour étudier et combattre les maladies exotiques. En Angola, en Afrique Orientale, en Guinée, le cholera, la peste bubonique, la maladie de sommeil, le beriberi, etc., ont été des sujets des investigations scientifiques assez remarquables, dont les rapports furent publiés, soit en volumes séparés, soit dans les Archives d'Hygiène et de Pathologie Exotique, publication de l'Ecole de Médecine Tropicale de Lisbonne.

Les noms des Professeurs A. Bittencourt, A. Ropke, J. de Magalhaes et des Docteurs Correa Mendes, F. Sant'Anna, B. Costa et encore beaucoup d'autres, montrent l'activité scientifique des jeunes médecins portugais dans tout ce qui concerne

la pathologie exotique et la prophylaxie sanitaire aux pays chauds.

Maintenant c'est la mission médicale à l'Ile de Principe celle qui a battu le *record* du succès. On peut considérer le résultat de cette mission comme un vrai triomphe de la science contre un fléau terrible—la maladie du sommeil. Il faut faire une référence toute spéciale à cette mission travaillant à présent à l'Ile de Principe et dirigée par le Dr. B. Costa, ancien élève de l'Ecole de Médecine Tropicale de Lisbonne. Le premier rapport présenté par le médecin au Gouvernement nous montre les difficultés du combat contre cette grave maladie. D'après les nouveaux renseignements, qui ne sont pas encore publiés, fournis par les Docteurs Costa et F. Sant'Anna, la réussite de la mission est complète. La maladie du sommeil ravageait la population nègre, la mortalité était épouvantable; l'Ile se dépeuplait et les propriétés agricoles étaient presque abandonnées. Les colons européens voyaient tous leurs éfforts perdus. L'intervention du Gouvernement ne se fit pas attendre. Il faudrait un combat à outrance; mais la terreur des blancs ne fut pas assez forte pour se soumettre à la prophylaxie commandée par le premier chef de la mission, M. le Dr. C. Mendes. Une nouvelle poussée de la maladie rendit le danger encore plus grave. Le Gouvernement a pris alors la résolution de donner tous les moyens administratifs à M. le Dr. B. Costa. Ce médecin s'est mis au travail assez rudement, mais il a très bien réussi. A présent pas de glossines à l'Ile de Principe, pas de maladie du sommeil. C'est sans doute un vrai triomphe pour les médecins. Ils ont fait revivre l'agriculture, les propriétés presque abandonnées se sont remplies de nouveau, le bien-être se repand partout. Tous les européens benissent aujourd'hui la guerre aux glossines, la ségrégation des malades et la rigueur des mesures hygiéniques.

[*Translation.* —Professor Dr. Silva Telles (Lisbon) reviews the prophylactic measures which have been put into practice in the Portuguese Colonies during the last ten years. He shows the scientific influence of the School of Tropical Medicine at Lisbon in this sanitary transformation. The programme of study and work of the Portuguese School is nearly that of the Schools of Tropical Medicine at London and Liverpool.

The oldest of the schools of medicine in the colonies of European countries has been organized by the Portuguese at Nova-Goa. It has existed for nearly a century. Many of its pupils are scattered through British India and East Africa. They have contributed largely in making the benefits of a sanitary policy and rules of hygiene understood by the natives.

In the Portuguese Colonies there are meteorological observatories and stations well supplied with instruments. These

are effective auxiliaries to the services of hygiene and colonization. The observatories of Loanda and Lourenço-Marques are celebrated for their work.

The colonization services have been organized recently. The study of regions capable of colonization, where the settlement of Europeans is likely, owing to the considerable altitude of these regions (1,400 to 2,000 metres), deserves the full attention of the Portuguese Government. There are at the present time good laboratories for bacteriology and the study of parasites in almost all the Colonies. They are directed by former pupils of the Lisbon School of Tropical Medicine. Some of these young doctors have already done excellent work on sleeping sickness, bubonic plague, leishmaniasis, etc. The influence of these laboratories is considerable, because they also direct the services of disinfection and sanitary assistance to the natives. In these laboratories at Loanda, at Lourenço-Marques, at Nova-Goa, much work is done on sleeping sickness, bubonic plague, and on almost all the scourges which from time to time ravage these Colonies. Medical assistance for the natives and poor Europeans has been established for a long time. In all the Colonies there are hospitals, infirmaries, ambulances, and free consultations. The vaccination service, notwithstanding the difficulty of making its utility understood by the natives, gives good results. Even in the most remote Colonies, in Timor, vaccination is practised regularly. There are even people who are re-vaccinated without repugnance and without fear. The Lisbon Geographical Society, whose work on all colonial questions is very conspicuous, is about to send a medical mission to Angola for vaccination service in the region traversed by the Lobito-Katanga railway.

Medicaments are distributed gratis to natives who cannot afford to buy them. Agricultural labourers, whether working on State lands, or on private estates, have the right of receiving medicaments gratuitously.

Several scientific missions have been sent out by the Portuguese Government to study and combat exotic diseases. In Angola, in East Africa, and in Guinea, cholera, bubonic plague, sleeping sickness, beri-beri, etc., have been the subjects of noteworthy scientific investigations, the reports of which have been published, either in separate volumes or in the *Archives of Exotic Hygiene and Pathology*, the publication of the Lisbon School of Tropical Medicine.

The names of Professors A. Bittencourt, A. Ropke, J. de Magalhaes and Doctors Correa Mendes, F. Sant'Anna, B. Costa, and many others, indicate the scientific activity of young Portuguese doctors in all that relates to exotic pathology and sanitary measures in tropical countries.

The medical mission in the Island of Principe has now beaten the record of success. The result of this mission may be considered a real triumph of science against a terrible scourge—sleeping sickness. Special reference must be made to this mission working at present in the Island of Principe and directed by Dr. B. Costa, a former pupil of the Lisbon School of Tropical Medicine. The first report presented by the doctor to the Government shows us the difficulties of the fight against this grave malady. According to the latest information, not hitherto published, supplied by Doctors Costa and F. Sant'-Anna, the success of the mission is complete. Sleeping sickness was ravaging the negro population and the mortality was frightful; the island was becoming depopulated and the agricultural estates were almost abandoned. The European colonists saw all their efforts wasted. The intervention of the Government was not long in coming. A "fight to a finish" became necessary, but the terror of the white residents was not sufficiently great for them to submit to the measures ordered by the first chief of the mission, Dr. C. Mendes. A new outbreak of the disease rendered the danger still more serious. The Government then resolved to give full administrative powers to Dr. B. Costa. This doctor set to work somewhat rigorously, but he has succeeded well. At the present time there are no *Glossina* in the Island of Principe, and no sleeping sickness. This is undoubtedly a real triumph for the doctors. They have caused agriculture to revive; the almost abandoned estates have been newly planted, and well-being is spreading everywhere. All the Europeans bless to-day the war on the *Glossina*, the segregation of the diseased, and the rigour of the hygienic measures.

Dr. Harford (Principal, Livingstone College, Leyton): Mr. Chairman—I should like to emphasize the very great importance to those who are concerned with tropical estates of dealing with this question of Tropical Hygiene, and with you, Sir, in the chair, I am sure that the matter ought to be impressed very earnestly upon the Congress; because it is owing to you, Sir, that such wonderful changes have taken place as have been just described by Mr. Evans. I should like to say that, in addition to the measures that ought to be taken for dealing with mosquitoes, I think it is of the utmost importance that the question of quinine prophylaxis should be remembered in the case of labourers who have come into regions and have been infected, or in cases where the reduction in the number of mosquitoes has not been able entirely to keep down the spread of malaria. But I specially rose to ask to be permitted to refer to another matter which I think is of the utmost importance concerning hygiene in the tropics, and that is the question of the supply

of liquor to natives, especially in connection with tropical estates. This matter was brought before the last Congress, and I thought it would be of interest to this meeting to mention some practical results which have issued from a discussion of this subject in the section of Hygiene at the last Congress at Brussels. As the result of a paper presented by Dr. Kermorgant, of Paris, a series of resolutions was passed by the Congress, a copy of which I have in my hand, and these resolutions, which were specially brought forward and supported by Baron Joseph du Teil, of Paris, particularly referring to Africa, formed the basis of an International Memorial which was made to the Official Conference of the Powers of Europe, summoned in Brussels in January, 1912, to consider the question of the spirit trade in Africa. This Memorial was presented on behalf of an International Federation which represented eight or nine different European nations—in fact, all the chief colonizing Powers—and it is a particularly interesting point of this movement that there are groups of men in all the different countries of Europe who are united together to deal with this question of the supply of liquor to natives, which I believe has a very important bearing upon the efficiency of labourers in the tropics. Personally, I think that one of the greatest causes of want of efficiency amongst labourers in many parts of the tropics is their use and abuse of alcohol, and that this question is one which ought to be very much brought to the front. I think it is a very fortunate thing that this question of the supply of liquor to natives, and of the relation of liquor to hygiene, has been taken out of the sphere of conflict in which it is so often found, especially in the so-called temperance movements, and that the various Planters' Associations in different parts of the tropics have taken up this matter, especially recently in Ceylon, where the question of increased facilities for the supply of liquor to natives is a matter of very serious concern. The matter has also been raised by the tea planters in Assam, who have felt very seriously the risks involved if the facilities for obtaining liquor, especially if that liquor is not of good quality, were not carefully restricted. I just wish in a word or two to refer to the reforms that have recently taken place in Africa with regard to this subject since the last Congress of Tropical Agriculture at Brussels. Since the presentation of the International Memorial to which I have already referred, there have been the following series of reforms: Belgium has now prohibited the spirit trade throughout the Congo so far as natives are concerned. Portugal has taken similar action in the Congo Province of Angola. The reforms instituted by France have been so remarkable that I cannot even summarize them here. Suffice

it to say that considerable districts of the hinterland of the Ivory Coast and Dahomey have been declared prohibited as regards the sale of liquor to natives, while the sale of absinthe has been prohibited throughout the French West African possessions.

As regards other countries, Germany and Great Britain have taken very strong steps in Africa—though not nearly as strong as are needed—during the last few years. But I must not further intervene in this discussion, except to say that I earnestly hope those who are here will make themselves informed on this subject, and that whilst I have been chiefly concerned all my life in anti-malarial work, and in supporting the work which our Chairman has so splendidly set on foot, of making known the discoveries that have had such far-reaching effects on the welfare of those who work in the tropical possessions, yet at the same time I earnestly hope that this question of the influence of liquor will not be lost sight of, as I believe it to be of the greatest importance that its physical and moral effects should be recognized by every worker in the tropics.

Mr. Edward Knox (Queensland): Mr. Chairman and Gentlemen—I suppose I owe some apology to this Congress, not being a medical man, for venturing to speak on this subject, but having been for more than thirty years connected with the production of sugar in Queensland—which I think is the largest tropical dependency of Great Britain—and in Fiji, another important British possession, I thought that I might say something with regard to the problems of sanitation with which we have endeavoured to deal in these Colonies. In Queensland the Government of Australia has decided for certain reasons that European labour should henceforth be used in the development of that State; and the problems which we have had there have been in connection with handling European labour in a tropical climate. So far as I am aware, in no other place in the world has an attempt been made to do agricultural work in the tropics with white men. In Queensland it is possible, partly, I think, because the climate of Queensland differs from that of every other tropical region of which I have heard. The unusual coolness of the nights in winter, the freedom from malaria, and the dryness of the atmosphere for a large portion of the year are very material factors in preserving the health of the men employed, and so far as the men are concerned there does not seem to be any reason why with protective duties—provided there is sufficient money to pay the extra duties—the work of tropical agriculture should not be performed by Europeans there. That it can ultimately be so performed when natural conditions only come

into play I do not believe. I do not believe that you will ever keep a large population of white married men with their wives and families engaged in tropical agriculture in any part of the world, even in Queensland. But that is, of course, a matter of personal opinion, which I may be pardoned for expressing. It is only necessary for me to say with regard to the health problems there that we have never had any difficulty or any outbreak of disease. Australia is a very healthy place, even in the tropics, and although all our sugar factories there are almost on the sea level, and in districts which have a high rainfall and are wooded, we have had no outbreak of disease and a very small death-rate, because only extremely healthy men can take up the work. I think there is nothing I need say further about Queensland. In Fiji, on the other hand, although the islands are in the same latitude as the districts in Queensland where we work, we have had somewhat different problems. In the first place, the whole of the field labour is supplied by labourers imported from India, and we have to care for their wives and children as well as for themselves. In speaking of our care for them, I should first state that the whole of the Government regulations are very stringent in regard to the housing and feeding of the people, so far as the feeding devolves upon the employers; and the arrangements made, I think, are exceedingly good and effective. I only regret that there is not somebody here to-day connected with the medical service of Fiji, who could tell you what is done. But on the whole our thirty years' experience in Fiji with this labour question has been satisfactory from the point of view of health. There also we have no malaria. Another important factor is that the wages paid in Fiji exceed very considerably those which have been stated by Mr. Evans for the Malay States.

Dr. Fernando (Ceylon): Mr. Chairman and Gentlemen—I should like to make a few remarks in connection with this subject from the experience I have gained in Ceylon. I quite agree with Dr. Sansom and Mr. Evans as to the importance of preventive measures connected with tropical diseases in order to secure an improvement of the efficiency of the labour supply on tropical estates. As regards Ceylon, we have practically three important diseases to contend with, namely, dysentery, ankylostomiasis, and malaria. Fortunately for us, both cholera and small-pox are efficiently dealt with by the ordinary measures of quarantine and vaccination. As regards dysentery and ankylostomiasis, general measures of water supply, sanitation, and so on will diminish these diseases very rapidly, but as regards ankylostomiasis I should like to say that, apart from clean water supply and sanitation of estates, we find it

impossible to start a regular campaign, because most estates are already infected with the disease, and labourers coming from Southern India are also infected; and therefore I do not think much amelioration of this disease can be expected until adequate treatment and notification of the disease is undertaken on the estates, just as they have been with success in British Guiana recently. But as regards malaria, although in Ceylon we have been discussing this question for well-nigh sixteen years, I am sorry to say we cannot show the brilliant results which have been achieved in the Malay States. We have not got out of the stage of discussion and general committee work started by the Government, and I am afraid that until a permanent Malaria Board, or something of the kind, is formed, and a competent staff of permanent officials are told to set measures going, we shall not achieve much result in mitigating malaria in Ceylon. For one reason, we may say that conditions are rather different from those of the Malay States. In our hill country, in altitudes above 2,000 ft., we have no malaria at all, and between 1,000 and 2,000 ft. only a few spots which are slightly malarious; while, on the other hand, in the low country we have intensely malarial districts, in some of which the splenetic index is over 80 per cent., and in many others very high indeed. But so far we have not gone in for any practical scheme which has done any permanent good. Therefore, I think it is quite essential that for the permanent reduction of malaria in these malarial districts we should have a Malaria Board, with a permanent staff of officers, to carry on the work in a complete manner.

Mr. E. G. Broadrick (British Resident, Selangor, Federated Malay States): Sir—I would like to say just a few words on the attitude of the Federated Malay States Government in regard to the liquor question, which has been brought up to-day. The addiction of the Indian coolie to liquor has been a source of anxiety to everybody connected with him for a great many years past. I remember the time when port wine was his favourite drink. It was said it could be laid down in the country at two dollars a case, exclusive of duty. It has now been superseded by spirits of European origin, and there are constant complaints by the planter of his coolies being incapacitated, and of permanent bad results being effected in his labour forces, owing to the amount of liquor consumed by the coolies. It has now, by an enactment passed not long ago, been made a criminal offence to sell European spirits to any agricultural labourer of Indian origin, and proceedings have been taken under this enactment in several cases with very good results. Convictions have been obtained, and it is well known now that spirits may not be supplied to Indian coolies.

They, however, are taking to various other things. Beer was supposed to be a safe drink in the Federated Malay States, and can be imported free of duty; but it is now found that the native shopkeeper is supposed in some way to be adulterating his beer, and the beer is a very potent liquor indeed. A Food and Drugs Act which has recently been passed will, it is hoped, enable the medical officers by analysis to detect any adulteration. It is also feared that there is adulteration in toddy. Toddy is the native drink of the Indian labourer, and we have always said that if he must drink he must be encouraged to drink toddy. But recent instances have led us to fear that toddy also is subject to adulteration.

Mr. G. H. Golledge (Ceylon): Mr. Chairman and Gentlemen —I did not come prepared to speak on this subject to-day, but I should like to emphasize Dr. Fernando's remarks with regard to the way coolies come from India impregnated with ankylostomiasis. It would seem a point for inquiry as to what is being done by the Government in India before the coolies come to us. There is no doubt that the medical aid question has received very considerable attention, certainly in Ceylon, of late years. An enormous amount of money has been spent by proprietors of estates to eliminate disease as much as possible on estates, and I think a very great deal has been done and a marked improvement made. One of the speakers referred to the influence of alcohol with regard to disease, and there is no doubt that we are very much handicapped by that fact. It is to be hoped that now the Government have taken steps to control the liquor traffic, some improvement will take place.

Sir Sydney Olivier: Mr. Chairman—With reference to the statement by previous speakers that in some of our British Colonies it has been found that natives of India, imported as labourers, were highly charged with ankylostomiasis, I wish to say that almost any Government would do well not to take it for granted that ankylostomiasis is imported necessarily by alien labourers. Our attention in Jamaica was drawn to ankylostomiasis very largely by the fact that we had imported natives of India who suffered from it, and suffered from it very largely because they were in barracks on the estates. Having had our attention called to it, we then proceeded to make an ankylostomiasis survey of our population, and we were able to do so by taking those classes of population which came under control in the prisons, the hospitals and asylums. You may say that is not a very representative type of population, and that it is necessarily a part of the population which is perhaps in a rather low state of vitality. We found then that although the general idea was

that ankylostomiasis was a disease imported by the Indian coolies, practically the whole of our coolie population was infected by it, to the extent of 70 per cent. We consequently took up as a general measure the necessity of dealing with ankylostomiasis; and there is no doubt whatever that if we interest agriculturists in this question as a matter of labour efficiency, we shall have a very great deal of assistance from them on a subject which has been hitherto regarded as simply a question of hygiene and one confined entirely to the province of medical aid. I am convinced that a large amount of the somewhat apathetic disposition of native labourers is due to latent disease, which continually depresses their vitality. That is the case with regard to malarial fever in the West Indies. A great many do not show any active signs of malarial fever, but they have malarial fever in their system, and consequently are subject to diminished vitality on that account. Malarial fever must almost necessarily be dealt with by Government and not by local authorities. Any Government which sets to work and spends even a few thousand pounds can effect an enormous saving in the life of its population and in the health of its inhabitants. But we have constantly to be on the watch because, as has also been said in the course of the discussion, altered conditions will alter the virulence of the disease. We found in Jamaica that whereas, in large portions of the country, we had considered that we were immune from malarial fever, when we sent our labourers down to the Panama Canal they contracted there a somewhat different shade of malarial fever, from a somewhat different kind of parasite, and when they went back to those healthy regions of Jamaica we found that they did infect those who had hitherto been immune from the local malaria. Owing to such results as that, we are continually faced with the question of drainage, and, as has been said by a previous speaker, as soon as you begin to cultivate hillsides, and set up drains across estates, you at once introduce malaria into various parts of the country which have been hitherto immune, because you set up drains which, although theoretically running drains, are drains which collect a certain amount of stagnant water in the weeds by the side of them. In that respect also we have to bring the planters in to take counsel with the Government, and we have had to assist them, and show them how to make their drains, and how essential it is to their estates to do so in the right way. The particular local conditions of the population, and the general interest of the public health, are continually interacting upon one another. I have nothing more to add, except to say generally that I have listened with great interest to what has been said, and that I think that our mutual contributions to a

subject of this sort ought to be very encouraging to the districts which we represent.

The Chairman: I wish first of all to thank the lecturer for the most interesting address written by himself and Dr. Sansom. I entirely and cordially endorse almost everything he has said. I am fully acquainted with the work that is being done in the Federated Malay States, and have followed it for many years. I wish to mention here also the name of Dr. Malcolm Watson, who is well known in connection with the very active measures he has persuaded the planters and the Government to adopt in certain parts of the Federated Malay States. I must congratulate Mr. Evans also upon the thoroughness shown by his system, of which I quite approve. I am afraid there is no time for me to say more on his very interesting paper, although there are many points in it which I would like to discuss. I want also to thank Dr. Fernando for his very excellent idea that a standing Committee should be formed to deal with malaria in Ceylon. He himself has done much important and useful work in connection with malaria in Ceylon, and if he could get such a Committee formed it would doubtless be able to do a great deal of good. Of course, Ceylon is a country in which very much useful work of all kinds has been done in general sanitation and in the sanitation of plantations, and I feel that they will get ahead very soon. I think Sir Sydney Olivier's remarks, too, have been very interesting, and I wish particularly to explain a point that he referred to, namely, the fact that coolies suffer from malaria when they are moved off to other places. The Jamaica coolies, for instance, are almost free from malaria when they are in Jamaica, but when they go to Panama they are at once attacked. The same thing has been observed in many other places. We must remember, however, that there are three different diseases included under the head of malaria, and the coolies may become immune to one of the malarial diseases in Jamaica, and may be attacked by another species of parasite when they get to Panama. That is one explanation, but there are many others. Now in thanking the lecturer and all the speakers, I should like to conclude with a suggestion, namely, that this Congress of Tropical Agriculture should appoint a standing Committee to consider the whole of this very important subject—important to agriculture and important to humanity—that this Committee should consider it and report its findings to the next meeting of the Congress. I am not a member of the Congress, and I am not a tropical agriculturist, but I believe that this course might commend itself to the Organizing Committee of the Congress. There is not time to discuss such a resolution, but I believe your

President will endorse it, and perhaps you may be persuaded to adopt it at once without discussion. It is an evident proposition that this Congress should appoint a Committee to deal with this subject, and I do not think anyone is likely to oppose it.

The PRESIDENT: Gentlemen—I should like to support very warmly the proposal which Sir Ronald Ross has just made, that a Committee should be appointed to consider the various details of the very important question which we have discussed this morning. It is quite obvious that in a Congress of this kind we cannot hope to discuss thoroughly every subject which comes before us, but when we realize, as we do this morning, that there is an important subject which requires more consideration than we are able to bestow upon it, our best plan is to appoint a Committee to deal with it. I have, therefore, the greatest pleasure in supporting Sir Ronald Ross's proposal, that a Committee should be appointed to deal with this question, the Committee to report on or before the occasion of the next International Congress.

The CHAIRMAN: If you will allow me, I will put that at once without discussion, as our time is already finished. I do not think anyone will oppose it. That is passed *nem. con.*

The PRESIDENT: Before we conclude this part of our business, perhaps the meeting will allow me to propose a very hearty vote of thanks to the reader of the paper, and to those who have taken part in the discussion, and also to Sir Ronald Ross for so kindly coming here this morning and presiding at this meeting.

This was carried by acclamation.

Mr. F. D. EVANS: Mr. Chairman and Gentlemen—I am very much obliged to you for the way in which you have received this paper by Dr. Sansom and myself. I am only sorry that there has not been more active hostile criticism on parts of it, because, unless we are up against a certain amount of opposition, I have always found that very little is accomplished. There are at the door a number of publications of the Agricultural Department of the Malay States which may possibly be of interest to some of you in connection with the proposal which was made by our President yesterday with regard to the establishment of an agricultural college. Also, if any of you are interested in the actual methods which we employ in the Malay States to drain land, I should be delighted to explain them in the Reading Room immediately after this meeting.

WEDNESDAY, JUNE 24.—MORNING SESSION,

11.45 A.M.

Legislation against Plant Diseases and Pests.

Chairman: SIR SYDNEY OLIVIER, K.C.M.G., *Permanent Secretary to the Board of Agriculture, formerly Governor of Jamaica.*

THE CHAIRMAN: Gentlemen—The subject for discussion at this meeting is "Legislation against Plant Diseases and Pests," and it is a subject in which I hope this Congress will take particular interest. It is a subject which we shall be treating in a somewhat different manner from that in which we have dealt with our subjects hitherto. Hitherto we have had contributions from men of experience in different branches of agriculture, telling us what they have done, what methods they have pursued—they and their Governments and their Associations—as a sort of object-lesson in what might be done in other parts of the world. But to-day we shall be dealing rather with what is truly an international question; that is to say, the question of regulations to be made in all countries and all colonies with a view to diminishing the probability of the spread of plant diseases from one country to another, as well as in any particular country. It is a good many years now since the attention of the world was called to the necessity of this by the outbreak of two very serious diseases, the phylloxera in France and the coffee disease in the East. Those two outbreaks called the attention of the world to the necessity both of some kind of internal administrative reform, and also, if possible, of some kind of international Convention with regard to the restriction of such diseases. As a consequence of those outbreaks we have had a progressive study of plant diseases, and a progressive study also of the methods of dealing with and controlling those diseases so as to prevent their spread in the countries

where they have prevailed, and also to prevent their contagion being carried from one country to another. As long as the progress of agriculture throughout the world and in the tropics increases with that great rapidity with which it is increasing at the present time, and the trade between one country and another develops, the danger of the infection of one country with the plant diseases of another must tend to become more and more intense. I speak in this connection with great interest of an institution of which the foreign delegates here know, perhaps, more than some of our British delegates do—that is to say, the International Agricultural Institute at Rome. That Institute was founded seven or eight years ago by the munificence of the King of Italy. The King of Italy handed over for the purpose of founding and maintaining that Institute an estate which brings in a revenue of 300,000 lire per annum. Out of that munificent donation a splendid office and palace were built at Rome. Beginning with the study of the various processes of production of agricultural products, the Institute has gone on to consider the interests of agriculture from the international standpoint by the study of the diseases of animals and of plants. The Institute has advanced progressively in the direction of endeavouring to induce all the Governments of the civilized world (and all the Governments of the civilized world are represented in that Institute) to establish services for the inspection of diseases of plants, with a view to substituting for the absolute prohibition of the importation of plants and seeds conditions under which plants and seeds may be introduced without danger to the agricultural economy of the country introducing them. The general system which that International Institute, representing all civilized Governments, aims at is to enable all Governments to do what the foremost are already doing—to have a fully-equipped Department of Agriculture to study the entomological and fungoid diseases to which plants are subject with a view to notifying immediately whether such diseases do exist or not, so that commerce may be carried on with safety, and agriculture may be set forward in all the world, by a combined attack upon disease of every form in every climate. A special Conference was held this spring of eminent agriculturists from Europe, America, and Asia, and Mr. Rogers at that Conference represented the Department of Agriculture of this country. We were also represented by

Sir James Wilson, who is a member of the Board of Agriculture. Mr. Rogers will to-day give us an account of the lines upon which that International Parliament of Agriculture has recommended that action shall be taken by all Governments for the regulation of plant diseases, and for the promotion of the commerce of the world with safety and with increased hope for the future. I have very great pleasure in now calling upon Mr. Rogers to read his paper upon the work done by that Conference at Rome.

THE INTERNATIONAL PHYTOPATHOLOGICAL CONVENTION OF ROME AND ITS RELATION TO TROPICAL AGRICULTURE.

By A. G. L. Rogers,
Board of Agriculture.

[Abstract.]

(1) History of the movement in favour of international action for control of plant diseases.
(2) The Congress at Rome, February-March, 1914.
(3) Summary of draft convention of Rome.
(4) Inadequate representation of tropical countries.
(5) Summary of legislation and regulations at present in force in tropical and sub-tropical countries.
(6) Comparison of these regulations with those contemplated by Rome convention.
(7) Advantages and disadvantages of the proposed change of method.

[Discussion.]

Dr. C. J. J. van Hall (Department of Agriculture, Buitenzorg, Java): Mr. Chairman—I have listened with considerable interest to the paper of Mr. Rogers. As regards the three different ways which he suggested to prevent the introduction of diseases and pests from abroad, I am afraid that two of them, viz., eradicating completely the disease in its home country, and controlling all shipments of plants and seeds in the country of origin, will never be regarded as sufficient by the country which desires to import the plants or seeds. Each country will in the end have to rely upon itself for controlling the plants and seeds imported. Besides, it must not be forgotten that it often happens that a disease has only just attacked a plant when it is shipped, and that it is then almost impossible to detect its presence, while on arrival at its destination

the fungus has developed, or the insect has hatched from the egg and it is much easier to detect the enemy.

In establishing control of imported plants we meet, however, with the difficulty that almost every country has its own system of controlling the imports and a great number of very different laws and regulations are met with. The way in which these laws are carried out are also different, but on this point, as well as on the effect of the laws, very little information is published.

It would be useful if there were more exchange of opinions about these questions between the phytopathologists in different countries, and, without making a definite proposal to the Congress, I should like to emphasize the desirability of such an interchange of opinions between the competent men in different countries as to the way in which the laws against the introduction of disease are carried out and as to the effect of these laws.

Professor P. Carmody (Director of Agriculture, Trinidad): Mr. Chairman and Gentlemen—I think that the subject which has been introduced so ably by Mr. Rogers is one which can be suitably dealt with at this Congress. We have this advantage, that we are able to obtain personal knowledge of each other at these Congresses, and that by this means we are able to ascertain what is being done in other countries in connection with plant diseases. The chief trouble, I think, which confronts anyone importing plants from any other country is to know what are the conditions and the regulations in that country, and to know how they deal there with plant diseases, or whether they are entirely ignorant of them. That is the one question, I think, that precedes every other. Let me assume, for example, that I want to import sugar canes into Trinidad. If I sent to my friend, Dr. van Hall, for these sugar canes, and he sent me a certificate that there was no disease in the district from which these canes were taken, and that they suffered from no special diseases of the sugar cane, I should not have the slightest hesitation in admitting these into our colony, perhaps entirely without fumigation, although sometimes we may protect ourselves by that in certain cases. But if the Director of Agriculture in some little-known part of the world were to do the same, and sent me a certificate similar to the one supplied by Dr. van Hall, I should want to know first of all whether he was competent to give a certificate, or whether any preventive measures taken at the place of origin were efficient. After attending these Congresses and exchanging subsequently, as we do, our publications not only among the Departments of Agriculture in the British Empire, but very largely also outside—in fact, with almost all the Departments of Agriculture throughout the world—we are

pretty well aware of what diseases are prevalent in any of the countries with which we are likely to deal; and I may say at once, Sir, that I think the prevention of the importation of plants—complete prevention or prohibition—is obsolescent. We have come to that stage now that we must receive plants from certain places, and must adopt such measures as will enable us to introduce them with safety. Some of these measures have been set forth by Mr. Rogers in his paper. For instance, a certificate of freedom from disease from a competent authority. That is essential. Fumigation in the country of origin is a thing upon which I would not rely. It all depends upon how it is done, and it is not successful in all cases even where it is thoroughly done. Inspection at the country of import is also absolutely necessary, and fumigation there is necessary in certain cases. These are the measures that will have to be adopted, and I think, Sir, that as we progress in our knowledge of the methods of introduction of plants—we are really in a state of evolution in regard to our knowledge of these plant diseases—our planters and our Governments will insist upon the importation of plants only from those countries in which a certificate from a competent authority can be obtained. I think that will be the commercial ending of the question.

Professor Dr. Warburg (Germany): Mr. Chairman and Gentlemen—I think this question is one of the most important with which we have to deal here, because the difficulty of getting rid of diseases, and the prevention of the introduction of fresh ones, is now very important for all tropical countries and colonies. But I think the matter is one upon which we cannot come to any definite conclusion here. We have heard already of some difficulties which are raised by certain of the proposals of the Rome Convention, and I believe that our tropical interests are so very great that we must form our own conclusions, and that will only be possible, I think, by appointing a Committee to consider the question. We have no idea which diseases have to be excluded, and even if the interchange of communications between the different countries and the different stations is now very frequent, it is impossible, from the literature alone, to determine what is really necessary. And so I believe we must appoint an International Committee to prepare a report for the next Congress—a Committee consisting partly of phytopathological experts of the different nations, and partly of administrators who know what is possible in the different countries. Only if this is done can we propose any regulations to the General Committee, or to the Institute at Rome. It is impossible now, I believe, to take here any certain steps without going thoroughly into the matter, so I shall propose such a Committee for working out the question.

Dr. L. H. Gough (Chief, Entomological Section, Ministry of Agriculture, Egypt): Mr. Chairman and Gentlemen—The previous speakers have not referred to Egypt. In Egypt the present regulations are an extension of the legislation of ten years ago which totally prohibited the importation of cotton seed. Cotton seed and growing cotton plants are still totally prohibited, and, in addition, all other plants entering the country have to be fumigated. An amendment of the law is under consideration permitting the importation without fumigation of plants arriving with satisfactory inspection certificates. Such certificates cannot, however, always be trusted, and fumigation may yet have to be imposed, if the plants to which the certificates refer are found to be infected. In spite of the total prohibition of cotton seed, a small quantity of seed has been imported in badly ginned cotton from India, and in this way the pink boll worm has reached us. I should not like to see Egypt give away its right to fumigate, or to examine and reject plants, which, although properly certificated, are found by us to be diseased.

Sir James Wilson: Mr. Chairman—I was one of the Delegates representing Great Britain at the Conference at Rome which the Chairman mentioned in his opening speech, so that I may claim some knowledge of this question. I am glad of the opportunity of saying a few words with reference to what has been said by some of the previous speakers. There is no doubt that, in spite of the wording of the Draft Convention, each country will pay some attention to the adequacy of the agency which gives certificates. You cannot expect a certificate from one country which is known to be backward to be accepted in exactly the same way as a certificate from a more advanced and trustworthy country. The Draft Convention itself retains to each country the power to do what it likes with plants after they come to the country, and does not prevent any country from having an inspection made of any particular consignment regarding which it is not quite sure. I think perhaps that has not been quite understood. I can mention that the Hungarian Government has definitely notified its intention to adhere to the Convention, and from what I heard from some of my fellow Delegates at the International Agricultural Institute at Rome, it seems probable that a number of other European Governments will adhere. On the other hand, I understand the South African Government are not inclined to adhere, because their present restrictions, they say, are greater than those which the Draft Convention proposes to require, and they are afraid that if they adhere to the Draft Convention they will have to relax their restrictions against certain countries. I am inclined to think they are mistaken in that inter-

pretation of the Draft Convention, and that it is quite possible to adhere to the Convention and yet retain any particular restrictions that may be desired. The Convention simply says that no country which adheres to the Convention will admit plants without a certificate; it does not say that all countries which adhere to the Convention will admit plants that have such certificates. I think you will understand the distinction. It is quite possible for a country like South Africa to retain its own particular restrictions whilst adhering to the proposed Convention.

Now I should like to say a few words about tropical countries. I have lived in India, and I naturally look upon the question from the point of view of India. Mr. Rogers has said that in India we have no restrictions at all. As a matter of fact, I think we do fumigate cotton seed, but I think that is the only precaution we take. As regards the importation of cotton plants from other countries, India would no doubt be quite willing to accept the Convention, and to require certificates with plants imported. But there is this difficulty, looking at it from the point of view of India. The Convention says that the country adhering must promise to establish an efficient system of inspection of nurseries and places where plants are grown for sale or export. Now India is an enormous country, and to establish what in India we should call an efficient system of inspection for the whole country would mean an enormous expenditure, and would be exceedingly difficult to carry out. I tried to get an interpretation, at the Congress, of the meaning of the words "efficient system of inspection," but I was told that each Government must make up its own mind about that, that it was a matter for its own conscience, and that if the Indian Government thought it could say that it had an efficient system of inspection, there would be no difficulty with the Convention. That, I think, would be the chief difficulty for the Government of India in making up its mind whether it could conscientiously adhere to the Convention or not.

As regards the proposal that there should be a Committee appointed to consider the question further and to collect information about it, in the Draft Convention itself each country that adheres promises to arrange for the interchange of information between its expert staff and research institutions, and the International Institute of Agriculture at Rome is to be the means of collecting and communicating this information, as indeed it already is, to all the countries which adhere to the Convention, which means almost all the countries of the world. We have a *Bulletin* published every month which contains an account of plant diseases, and the International Institute is anxious to collect all the information it can about plant

diseases, and to publish that information in the *Bulletin*. I do not know from that point of view that there is any special necessity for the appointment of a Committee by this Congress, unless it is the case that possibly, as Mr. Rogers has said, hitherto the conditions of plant diseases in tropical countries, where the number of educated and intelligent people is comparatively small, have naturally not had the same attention paid to them as has been the case in more advanced countries. Possibly it might be advisable for this Congress to draw the special attention of the Institute at Rome to those diseases which affect plants in tropical countries, and to those particular conditions which are found in tropical countries, and which are not existent to such an extent in countries in the temperate regions, where, generally speaking, there is a larger expert staff and a much more intelligent population to deal with.

Mr. A. G. L. Rogers, in replying to the discussion, said: Mr. Chairman—A proposal, I gather, has been made for appointing a Committee to consider what can be done towards unifying and simplifying the regulations at present in force in tropical countries, and it is pointed out that one of the great difficulties is that no country is really quite certain as to the efficiency of the staff of other countries, and as to the value of the certificates which are given. If I may suggest to this Committee, if it be formed, a plan of procedure, I should like to propose that they should begin with perhaps twenty, perhaps thirty, of the more important diseases affecting different plants, perhaps the most important plants; that they should set to work to procure a survey of all the more important countries, so that an estimate can be prepared for each country stating the amount of a particular disease which occurs in that country, and indicating what the prevalence of the disease is, what is the seriousness of the injury, and how far the disease is spreading from year to year. That will be the first means of finding out not only how far these diseases are spreading, but what is the value of the certificates given by other countries. It is a somewhat similar plan to that which we have adopted in the temperate countries. In England, for instance, we have a regular system by which certain diseases are under inspection, and a map is produced every year showing exactly the amount of that particular disease in each county in England. Very much the same sort of thing is done under the Berne Convention relating to phylloxera; very much the same thing is done now with regard to certain other diseases in temperate countries, and every year more and more progress is being made in that direction. It is only by making first a careful survey of the diseases in your own country, and publishing its results to the rest of the world, that you can ever get the confidence of other

countries that the certificates which you issue are of any value at all. That is the only point I should like to bring out now, Sir.

The CHAIRMAN: I do not know whether Dr. Warburg, or any other member, wishes to make a motion for the appointment of a Committee. Mr. Rogers has suggested some lines upon which such a Committee might proceed. For myself, if I may be permitted to do so, I should like to express the opinion that I do not think such a Committee is necessary for this purpose, or that it would be likely to be more efficient than the agencies which we have already established for dealing with these matters. The International Institute at Rome has taken a great interest in this matter of plant diseases from the first, and, as Sir James Wilson has stated, it maintains a Bureau for recording the progress of legislation and the work of institutions for dealing with the diseases of plants. All the Governments of Europe are represented in that Institute. The Government of Germany is represented by Dr. Müller, a most efficient and active member of the Bureau, who takes a great interest in this matter; and the Government of France is represented by M. Louis Dop, who is one of the principal movers on this subject. The Government of France, I may add, has been the Government which has taken special interest in promoting international action in regard to plant disease legislation. Now this Institute at Rome exists, and is in working order. It publishes month by month a *Bulletin* in which it is now seeking to record absolutely the stage which has been arrived at by any country, both in regard to its institutions for dealing with plant diseases, and with regard to the extent to which disease prevails. For that purpose the public reports of every country are carefully scrutinized and abstracted, and I do not think any Committee would be able to get more full details than are already furnished by the countries which are turning their serious attention to this matter, and publishing annual reports. We must rely upon honesty in this matter, and upon public spirit; and as in human diseases, so also in plant diseases, all States are beginning to recognize more and more that what is to the interest of all is the immediate notification of any disease which exists, the public recognition of it, and, having got notification and public recognition of the disease, that steps should be taken to eradicate it. You have therefore in the Institute at Rome a permanent Committee whose members are specially interested in the work which this specially appointed Committee of yours would undertake; and I think a permanent Committee is much more likely to do useful and continuous work than a new Committee started by this Congress. The lines upon which the International Agricultural Institute at Rome should be permitted to work are

these. The various Governments should refer the Convention that has been drafted to their advisers and to their experts in tropical agriculture, I hope, as well as to their experts in European agriculture. The British Colonial Office certainly will have representations to make with regard to the bearing of the Convention on the restriction of disease in tropical countries. Every European country having a delegate at Rome is interested in furnishing the Institute there with information bearing upon its colonies or dependencies. Having got an international organ established, an organ which is really modifying in an important way public opinion in the less forward countries of the world in the direction of establishing institutions for the collection and distribution of intelligence with regard to plant diseases, let us do our best to make that organ efficient for its purposes, by instructing our representatives there as to what the demands of our tropical agriculture require, just as we instruct them as to what our domestic agriculture requires. That does seem to me the line upon which we can act most effectively. I think any committee set up by us might be useful as an advisory body, but it does seem to me a pity, when an institution has been definitely founded and endowed, as the International Agricultural Institute at Rome has been, for certain purposes, to be continually setting up small committees and institutions of no particular international status to deal with problems for which the International Agricultural Institute has endeavoured to find a continuous solution. Whatever we do in this matter, my personal view is that we should endeavour to get our ideas brought into play by making representations through our various Governments to the International Agricultural Institute at Rome, which is dealing with this matter and will continue to deal with it. That is only my personal view, having taken, as I have done, a great interest in the work of the International Agricultural Institute. We are just as fully alive to the necessity of proper regulations as to plant diseases, both in their tropical aspects and otherwise, as any member of this Congress, and we are particularly desirous of giving effect to the opinion of this Congress in regard to this matter.

The PRESIDENT: While I entirely agree with Sir Sydney Olivier in regard to the useful work which the International Agricultural Institute at Rome has done in reference to this question, I must remind him that this Congress is held under the auspices of the International Association for Tropical Agriculture, an Association which was founded long before the International Agricultural Institute at Rome. I mention that because he seemed to think the appointment of a Committee by us would be equivalent to encroaching on the ground of the

Institute at Rome. As a matter of fact the International Association for Tropical Agriculture was founded with a special sphere of work in tropical agriculture, and it would naturally feel disposed to undertake any investigation in connection with tropical agriculture such as this, which evidently needs special consideration from the tropical point of view. Dr. Warburg's proposal for the appointment of a Committee is strictly in accordance with our usual procedure in connection with the work of the International Association for Tropical Agriculture. Whether we do or do not appoint a Committee, this particular subject is evidently one for further discussion from our point of view, and I wish, at the same time, to support Sir Sydney Olivier's contention that in a subject in which the International Agricultural Institute at Rome has taken action, the International Association for Tropical Agriculture should co-operate for tropical agriculture and assist the Institute at Rome in its inquiries.

The CHAIRMAN: I suggest that the appointment of a Committee should be considered, and that any motion on the subject should be brought up at the final general meeting. I now declare the session at an end.

WEDNESDAY, JUNE 24.—AFTERNOON SESSION.

The Fertility of Soils in the Tropics.

Chairman: SIR SYDNEY OLIVIER, K.C.M.G., *Permanent Secretary to the Board of Agriculture, formerly Governor of Jamaica.*

THE following papers were read:—

SOME NOTES ON CERTAIN POINTS IN RELATION TO THE PROBLEM OF SOIL FERTILITY IN THE TROPICS.

By H. A. TEMPANY, B.Sc., F.I.C., F.C.S.,

Superintendent of Agriculture, Leeward Islands.

[ABSTRACT.]

In this paper attention is directed to the importance which biological factors have assumed in relation to considerations of soil fertility. It is pointed out that up to the present time the results available have been arrived at under temperate conditions; activities of this description are, however, limited in temperate latitudes by temperature range; the intervention each year of a winter period, during which biological activities in the soil are very greatly reduced if not entirely suspended, constitutes a limiting factor of great importance, which is absent under tropical conditions. In the latter case the prevalence almost continuously of a set of conditions peculiarly favourable to biological development causes such factors to assume a greatly enhanced degree of importance.

In the course of the paper data are given showing the temperature range occurring in soils in the Leeward Islands Colony, which illustrate the points alluded to above, the temperature never falling below 20° C. and very rarely exceeding 30° C.

Summarized data are also given showing the rate at which organic matter tends to disappear as the result of bacterial action in soils under these conditions, the amounts lost varying

between 12 and 30 per cent. of the total in periods ranging between six months and one year.

Results are also quoted which show that under certain conditions and in the presence of an ample supply of organic matter the nitrogen content of soils may show increases of appreciable magnitude as the result of the action of bacteria of the Azotobacter type, the existence of which has been demonstrated in soils throughout the Colony.

The importance of bacteria of the putrefactive type is alluded to; these, by the continuous liberation of carbon dioxide, assist in rendering available the mineral plant food of the soil; energy for these and other bacterial processes is supplied by organic matter. There is also the well-known mechanical effect of organic matter on the character of soils.

The results of a large number of manurial experiments on various crops have conclusively demonstrated the necessity for frequent applications of organic manures; these results have been substantiated in other Colonies.

The continued fertility of soils in the tropics seems very largely bound up in the maintenance of the supply of organic matter; more attention is necessary to this point in the tropics than under temperate conditions, as owing to more favourable circumstances it is used up much more rapidly by biological processes.

The question of the biological relationships of tropical soils is of much interest and importance; the natural conditions are particularly favourable to such development, and afford special facilities for study; it is to be hoped that in the near future this side of the problem will receive increased attention.

FERTILITY SURVEY OF THE EGYPTIAN DELTA.

By B. F. E. Keeling, M.A.,

Director of Physical Services, Survey Department, Ministry of Finance, Egypt.

[Abstract.]

Very extensive operations are now being carried out by the Egyptian Government for the improvement of the drainage of the low-lying parts of the Delta. At the suggestion of Lord Kitchener it was decided to make a detailed survey of the present condition of the land so that in years to come the improvement effected by the works now in progress can be assessed.

The fertility map shown with the paper is that of the first

area to be undertaken, known as the Central Gharbia drainage area. The land is divided into categories: good, medium, and poor land under cultivation, barren land, land under reclamation, and land on which at the time of survey there was standing water.

A check was put on the field surveyors by the determination of the salt-content of large numbers of soil samples taken as the work proceeded. It is well recognized that the presence or absence of salt is the principal determining factor in the fertility of the Delta land. The results showed that the fertility is a close approximation to a salt survey, the good land containing on the average 0·3 per cent., the medium 0·5 per cent., and the poor land 0·8 per cent. The barren land may contain up to as much as 25 per cent. of salt.

The close dependence of the fertility on the altitude above sea-level, or in other words on the amount of natural drainage, is shown by a comparison of the fertility map with a contoured map of the same area.

THE WATER SUPPLY OF EGYPT, 1913—1914.

By B. F. E. Keeling, M.A.,

Director of Physical Services, Survey Department, Ministry of Finance, Egypt.

[Abstract.]

The flood of 1913 was the lowest recorded for over one hundred years. A general account is given of the rainfall in the areas from which the Nile draws its supply, and of the methods by which the water is utilized in Egypt, with the two main divisions of *basin* and *perennial* irrigation, the limits of which are shown on a map. During winter there is always sufficient water for the perennially irrigated tracts, and the principal factor in irrigation is the *height* to which the Nile has risen, enabling more or less of the basin tracts to receive water. In summer there is often difficulty in providing the perennially irrigated areas with sufficient water, and it is then the *quantity* of water which is the controlling factor.

In 1913 the flood-level at Aswan was 2½ metres below normal, and 1½ metre below that of any previous year since the occupation. The effect of this on the irrigation of Upper Egypt, and the function of the *Esna Barrage* in providing water to basins which otherwise would have been left dry, are explained.

The low flood was naturally followed by a very bad supply during the early summer of 1914. The natural supply reaching

Egypt is supplemented by (*a*) the *Aswan Reservoir*, (*b*) *seepage* from the natural reservoir of the land along the river, and (*c*) water drawn from the subsoil by *lifting machines*. An estimate is given of the whole water supply and of the water requirements during the summer months.

The importance of the early *spring rains* in Abyssinia and on the Lake Plateau are also briefly discussed.

The paper is illustrated by maps and diagrams.

I TERRENI AGRARI DELLE COLONIE ITALIANE.

Per Dott. ARMANDO MAUGINI,[1]

Istituto Agricolo Coloniale Italiano.

[ABSTRACT.]

In questa breve nota sono esposte organicamente le conoscenze attuali sui terreni agrari delle colonie italiane di dominio diretto, in merito alla loro struttura fisico-meccanica e alla composizione chimica.

Una buona parte del materiale analitico citato è stato ottenuto a cura del laboratorio chimico dell'Istituto Agricolo Coloniale Italiano e si trova pubblicato a più riprese nella rivista dell'Istituto stesso o in relazioni di studio; alcune analisi però appariscono al pubblico per la prima volta in questa nota.

Tutti i campioni di terreni furono raccolti dal personale dell' Istituto Agricolo Coloniale Italiano o da corrispondenti, durante le numerose missioni di studio nelle colonie italiane. L'esposizione della materia è fatta in tre successivi capitoli dedicati alle singole colonie: Eritrea, Somalia e Libia. Per ogni colonia è prima riassunto utto il materiale analitico esistente, sono distinti i tipi fondamentali di terreni agrari e sono poi messe in opportuno risalto le caratteristiche fondamentali di ciascun tipo.

[TRANSLATION.]

THE AGRICULTURAL LANDS OF THE ITALIAN COLONIES.

In this brief note the writer has set out the information at present available respecting the agricultural lands in the Italian Colonies, in relation to their physical and mechanical structure and chemical composition.

A large part of the analytical material referred to has been

[1] Read by Dr. O. Manetti, in the absence of the author.

obtained through the chemical laboratory of the Italian Colonial Agricultural Institute, and has been published on different occasions in the *Review* of the Institute in connection with the studies made; some of these analyses, however, are now published for the first time.

All samples of soil were collected by the staff of the Italian Colonial Agricultural Institute, or by its correspondents, during the numerous expeditions sent out for the purpose of studying the Italian Colonies. The subject-matter is set out in three successive chapters devoted to the several Colonies: Eritrea, Somaliland, and Libya. For each Colony the entire existing analytical material is first of all summarized and a distinction made between the fundamental types of soil; the fundamental characteristics of each type are then considered according to their special importance.

COSTITUZIONE GEOLOGICA E REGIME IDROGRAFICO DELLA SOMALIA ITALIANA MERIDIONALE.

Per Professore Giuseppe Stefanini.[1]

[Abstract.]

Il territorio compreso tra il corso del Giuba a valle di Dolo, il medio corso dell'Uebi Scebeli ed il mare, territorio noto col nome di Somalia Italiana Meridionale, può distinguersi dal punto di vista geologico, in due regioni. La regione interna è un altopiano poco elevato, degradante alla pianura, e consta di un massiccio di rocce cristalline (granititi, gneiss, quarziti, ecc.), cui si addossa a nord ed a ovest una pila di strati sedimentari calcarei, attribuibili al periodo Giurese. Questi si estendono largamente anche a destra del Giuba del British East Africa; però verso l'interno (Lugh, Dolo) la base di questa serie sedimentare è formata di arenarie variegate e marne, con gessi. Le zone alluvionali che si osservano qua e là nella regione interna (Baidoa, Dafet, ecc.) sono costituite da un'argilla bruna, compatta e coltivate in parte dagli indigeni; essa contrasta per la sua fertilità, coi terreni eluviali del rimanente di questa regione (sabbie silicee e terra rossa), generalmente occupati da boscaglia (vegetazione di steppa).

La regione esterna è formata da una serie di colline sabbiose, litorali, di origine eolica: antiche dune alterate, in piccola parte cementate, e orlate esternamente alla base da arenarie o colcari di origine marina recente, i cui strati però non si osservano nè sollevati nè estesi verso l'interno, come avviene invece nella

[1] Read by Dr. O. Manetti, in the absence of the author.

Somalia Settentrionale Italiana e nell'Africa Orientale Inglese e Tedesca. Tra queste serie di dune e la regione interna si estende una larga zona di alluvioni argillose, dipendenti dal Giuba e dall'Uebi Scebeli; il quale ultimo, nella sua parte inferiore, deviato dalle dune, scorre per lungo tratto parallelamente alla spiaggia e a piccola distanza da essa si impaluda finalmente nella regione detta dei Balli. Le colline della duna sono occupate da vegetazione di steppa; tutta la parte alluvionale appare invece per la natura del suolo e per la positura lungo i fiumi, suscettibile di colture ed è, in parte notevole vantaggiosamente coltivata.

Tanto il Giuba quanto lo Scebeli sono adatti a fornire un' ingente quantità di acqua per l'irrigazione. La portata media del Giuba in piena nel suo medio corso fu trovata dall'ing. Fano di oltre 600 m^3 al secondo: [1] esso si impoverisce alquanto più a valle, causa le inondazioni cui dà luogo nel tratto Anole-Margherita, dove il suo letto è pensile.

La portata dell'Uebi Scebeli in piena ad Afgoi, fu stimata pure dall'ing. Fano a 270 m^3 al 1'', più a valle esso tende pure ad impoverirsi per l'evaporazione e gli infiltramenti.

Sono in corso studi accurati sul regime dei due fiumi per organizzare un regolare sfruttamento delle loro acque, a scopo di irrigazione.

I copiosissimi bestiami che pascolano in tutte le zone a vegetazione di steppa hanno la loro abbeverata in parte ai fiumi, in parte ai pozzi. La massa calcarea è infatti imbevuta di acqua, causa le sue fessure; l'acqua di base viene a giorno in vari pozzi, artificialmente scavati dagli indigeni nel calcare, ed in qualche punto affiora anche alla superficie stessa del suolo, formando così vere sorgenti (El Chondut, ecc.). Anche dove la pila calcarea è incisa, e forma pareti, si hanno sorgenti, la più ricca delle quali è quella del Baidoa; essa origina pure una piccola cascata, che potrà essere sfruttata per la produzione di energia. La plaga di rocce cristalline è priva di pozzi perenni, probabilmente a causa della coltre sabbiosa che copre il sottosuolo roccioso, la quale è permeabile ed instabilissima, non permettendo così ai pozzi ordinari indigeni di sostenersi; essa però deve dar luogo alla sua base ad un livello acquifero ad andamento irregolare.

Alcune delle vallette alluvionate dell'interno, sebbene prive di acqua superficiale, hanno però una corrente subalvea a non grande profondità (pozzi di Ureghei, di Heima, ecc.).

Nella regione esterna, la zono alluvionale, argillosa, è in generale povera di acque sotterranee, salvo nella vicinanza

[1] Fano R.—Del regime delle acque celle nostre colonie (Somalia Italiana).—Istituto Coloniale Italiano.—II Congresso degli Italiani all'Estero, Roma, 1911.

immediata dei fiumi. Lungo la riva si ha invece una falda quasi continua di acqua, generalmente un po'salmastra, che trae le sue origini dalla collina costiera ed ha al mare il suo livello di base.

Gli studi hanno condotto l'autore a ritenere, che le attuali risorse di acqua, specialmente per uso pastorizio, possono essere notevolmente accresciute mediante la trivellazione di pozzi in alcune parti della colonia, e specialmente nella plaga di rocce cristalline, in qualche parte delle zone alluvionali e nella zona costiera.

[TRANSLATION.]

GEOLOGICAL CONDITIONS AND HYDROGRAPHICAL SYSTEM OF SOUTHERN ITALIAN SOMALILAND.

The territory comprised within the course of the Juba below Dolo, the middle course of the Uebi Scebeli, and the sea, which is known by the name of Southern Italian Somaliland, may be divided, from a geological point of view, into two districts. The interior region is a tableland of low elevation sloping down towards the plains, and consists of a mass of crystalline rock (granites, gneiss, quartzites, etc.) which is covered in the north and west by a bed of calcareous sedimentary strata which may be attributed to the Jurassic age. These extend also for a considerable distance to the right of the Juba into British East Africa; towards the interior (Lugh, Dolo) the base of this sedimentary series is formed of variegated sands and marls with chalk. The alluvial zones, which are observed here and there in the interior region (Baidoa, Dafet, etc.), are composed of a brown compact clay and are partly cultivated by the natives. As regards fertility, the clay is in contrast with the alluvial lands of the remainder of this region (siliceous sands and red earth) which are generally covered by woods.

The outer region is formed by a series of sandy littoral hills of æolic origin, old modified dunes, for a small part cemented, bordered on the outside of their base by sandstone or limestones of recent marine origin, the strata of which do not seem to rise or extend towards the interior, as is the case in Northern Italian Somaliland and in British and German East Africa. Between these series of dunes and the interior region there extends a large belt of argillaceous alluvial lands bordering on the Juba and the Uebi Scebeli, which latter, being deviated by the dunes, runs in its lower course over a long stretch parallel to, and at a small distance from, the shore, and finally loses itself in swamps in the region known as Balli. The hills of the dunes are covered with prairie vegetation; the

entire alluvial part, however, to judge from the nature of the soil and its position along the rivers, appears capable of being cultivated, and even profitably cultivated, for a considerable part.

The Juba, as well as the Scebeli, is capable of supplying an immense quantity of water for irrigation. The average volume of the water of the Juba when at its height and in its middle course was found, by Engineer Fano, to be more than 600 cubic metres per second.[1] This volume is somewhat reduced farther down, by reason of the inundations to which it gives rise on the Anole-Margherita section, where its bed is on the incline.

The volume of the water of the Uebi Scebeli when at its height at Afgoi was also estimated by Engineer Fano to be 270 cubic metres per second, and, farther down, this volume also tends to diminish by reason of evaporation and infiltrations.

At the present time exact investigations with respect to the system of the two rivers are being carried out, with a view to organizing a regular use of their waters for purposes of irrigation.

Very large herds of cattle graze over all the districts where there is prairie vegetation, and these are watered partly in the rivers and partly at wells. The calcareous mass is, in fact, soaked through with water by reason of its fissures. The water at the base makes its appearance in various artificial wells, dug by the natives in the limestone, and, in some parts, also issues from the surface of the soil, thus forming real springs (El Chondut, etc.). Where the calcareous bed is cut through, forming walls of rock, springs are also to be found, the largest of which is that of Baidoa; this also forms a small waterfall which can be utilized for the generation of power. The region of crystalline rock has no perennial wells, probably by reason of the sandy layer covering the rocky subsoil, which layer is permeable and very unstable and chokes up the ordinary native wells; it must, however, give rise, at its base, to an irregular water-bearing layer.

Some of the alluvial valleys of the interior, although without surface water, have an underground current at no very great depth (wells of Ureghei, Heima, etc.).

In the outer region, the alluvial and argillaceous zone is generally poor in subterranean waters, except in the immediate neighbourhood of the rivers; on the other hand, there exists a nearly continuous strip of water, generally somewhat salty,

[1] Fano R.—On the water system in our Colonies (Italian Somaliland). Second Congress of Italians Abroad. Italian Colonial Institute, Rome, 1911.

along the shore, and this takes its origin from the hills near the coast and has its bottom level at the sea.

From the investigations carried out by the writer he has formed the opinion that the present water resources, especially for pastoral use, may be considerably increased by the boring of wells in some parts of the Colony, and especially in the zone of crystalline rocks, in some parts of the alluvial zones and in the coast district.

The following papers were taken as read:—

NOTE SUR LA FERTILITÉ NATURELLE DES TERRES DE LA VALLÉE DU MOYEN-NIGER.

Par M. J. Lemmet,

Directeur du Laboratoire d'Analyses de l'Inspection d'Agriculture à Dakar.

[Abstract.]

En dépit de leur faible richesse, en acide phosphorique et en chaux, les terres de la vallée du Moyen-Niger, sont des terres fertiles, et partout, où l'alimentation en eau leur est assurée, elles sont productives.

Cette fertilité naturelle résulte, d'une part (terres non inondées) d'un choix heureux des cultures, et d'une méthode culturale bien comprise; et d'autre part (terres inondées et terres irriguées) de l'enrichissement périodique de ces terres en éléments fertilisants, dans des conditions un peu spéciales: enrichissement direct en azote aux dépens de l'air (microbes fixateurs d'azote); enrichisssement en azote, acide phosphorique, potasse, chaux, et humus grâce aux substances complexes diverses, charriées par les eaux du fleuve (fumier des troupeaux, ordures des villages, etc.). C'est dans l'union étroite de l'élevage et de la culture, qu'est le secret de la mise en valeur veritable de ce pays.

[Translation.]

NOTE ON THE NATURAL FERTILITY OF THE LAND IN THE VALLEY OF THE MIDDLE NIGER.

Notwithstanding its poverty in phosphoric acid and in lime, the land forming the valley of the Middle Niger is fertile, and, wherever there is an assured water supply, it is productive.

This natural fertility arises on the one hand (in the districts not subject to inundation) from a happy selection of crops and a thorough understanding of the method of agriculture; and on the other hand (inundated and irrigated districts) from the

periodical enrichment of these districts with fertilizing elements, under somewhat special conditions: direct enrichment with nitrogen from the air (nitrogen-fixing bacteria); enrichment with nitrogen, phosphoric acid, potash, lime and humus, by means of various complex substances, carried down by the river waters (manure from the flocks, drainage from the villages, &c.). The secret of making this country of real value lies in the close union of cattle-breeding with cultivation.

DETERMINATION OF THE MANURIAL REQUIREMENTS OF SOILS IN THE BELGIAN CONGO.

By F. Smeyers,

Director, Colonial Office, Brussels.

[Abstract.]

The two following methods of investigation are used in the study of the soils of the Belgian Congo:—

(1) Mechanical and chemical analysis.

(2) Physiological analysis by plants, either by means of pot cultures or in field experiments.

For mechanical and chemical analysis two laboratories have been established in the Colony; one of these was first situated at Eala (Equator), but was transferred to Zambi (Lower Congo) in 1913; the other was erected at Elisabethville (Katanga) in 1912.

The work of these two laboratories is devoted exclusively to the study of soils. They both use the same methods of analysis (Wohltmann Method), so that comparable results are obtained. One hundred and twenty-seven analyses were made in these two laboratories in 1913. A number of chemical analyses of Congo soils were made also in Belgium in different Government laboratories.

This work is completed by physiological analyses of the soils by means of plant cultures. The necessary appliances for this study will be available before long in the Belgian Congo. In the meantime Mr. Schreiber, General-Director of the Belgian Agricultural Department, has conducted at the Hasselt experimental station a series of physiological analyses on five samples of soils taken at Zambi (Lower Congo), and four samples taken at Ganda-Sundi (Mayumbe). The nine samples were sown with maize and oats in pots.

This experiment is now in progress, and is intended to reveal, through the plant itself, the elements that should be added to the soils to increase their productivity. The method

depends on the fact that any particular plant requires the presence in the soil of a certain minimum of each of the necessary plant-food constituents in an assimilable form, and if the minimum of any of these constituents is not present the plant will not thrive.

The method in use at Hasselt is as follows:—

For each kind of soil, a number of pots are filled with the same quantity of soil, a layer of gravel being put at the bottom to assist the aeration of the soil.

Then manure is applied, taking great care to mix it well with the soil. In each series:—

The	1st	pot	receives	a complete manure.		
,,	2nd	,,	,,	,, manure without nitrogen.		
,,	3rd	,,	,,	,,	,, ,,	phosphoric acid.
,,	4th	,,	,,	,,	,, ,,	potash.
,,	5th	,,	,,	,,	,, ,,	lime.
,,	6th	,,	,,	,,	,, ,,	magnesia.
,,	7th	,,	,,	no manure.		

The same number of seeds are sown, and after they have germinated the same number of plants is left in each pot; these are then placed in the best possible conditions of warmth, light, and moisture. The experiment is repeated for each soil.

Photographs taken during the course of the experiments indicate that nitrogen is missing not only in the sandy soil of Zambi, but also in the clayey soil of Ganda-Sundi. The absence of phosphoric acid in the manure does not seem to affect visibly the development of plants in the Zambi soils. The clayey soil of Ganda-Sundi shows on the contrary a considerable deficiency of this constituent. There seems to be a great scarcity of potash in the latter soil, whereas in the Zambi sand, vegetation does not seem to be affected by the want of this constituent in the manure formula. Lime and magnesia have been, up to the present, without apparent influence on the plants in these experiments.

LA VALORIZZAZIONE DEL GIUBALAND PER LA COSTITUZIONE DI UNA SOCIETA ITALO-INGLESE PER LO SBARRAMENTO DEL GIUBA.

Per Dott. Nallo Mazzocchi Alemanni.

[Abstract.]

Il Giuba.—E un fiume di frontiera tra il B.E.A. e la Somalia Italiana Meridionale. Dalle sorgenti (Arussi) alla foce (Oceano Indiano) v'hanno 1600 km. Del suo corso, in parte

torrentizio, l'ultimo tratto da Bardèra alla foce (290 km. in linea retta, e 570 di corso) tratto a decorso fluviale e navigabile per alcuni mesi dell'anno, è quello che interessa al fine della utilizzazione agraria. Alcuni dati: profondità, 6-8-11 m.; larghezza 60-250 m.; massima piena in Ottobre e Novembre, massima magra in Marzo; per la portata (oltre 700 m^3 al 1″ in massima piena) può considerarsi circa *un decimo del Nilo*. Andamento dei terreni favorevolissimo alla irrigazione, correndo il fiume sulla dorsale delle amplissime piane circostanti. Terreni feracissimi e particolarmente adatti alla *coltura del cotone*.

L'idea di *sbarrare il fiume* per utilizzarne economicamente le acque a scopo agrario, appare come la più logoca a risolbere il problema della valorizzazione del Giubaland italiano ed inglese.

L'opera—per essere il fiume di frontiera—non si potrebbe e dovrebbe attuare che in collaborazione tra *capitalisti italiani ed inglesi*.

Tale Società dovrebbe sbarrare il fiume e compiere tutte le opere di canalizzazione necessarie a condurre l'acqua sulle zone de irrigare. Potrebbe avere solo lo *scopo industriale* (vendita dell'acqua ai coloni) o *industriale agrario* (anche la diretta coltura dei terreni).

Primo compito della società dovrebbe essere un largo e dettagliato studio preliminare della regione, a mezzo di una commissione di tecnici che dovrebbe trattenersi qualche tempo sul luogo per assumere tutti i dati indispensabili alla esecuzione del progetto definitivo.

L'opera, compiuta, porterebbe alla irrigazione di *varie centinaia di migliaia di ettari*.

La iniziativa per la costituzione di detta società dovrebbe partire da *due forti istituti finanziari-italiano ed inglese*—in collaborazione.

I quali quindi dovrebbero interessare i rispettivi Governi ai necessari accordi politici, e trattare le facilitazioni e il concorso di questi all'opera disegnata.

Cenni sulla presumibile potenzialità economica della società.

(Alcuni giudizi inglesi sull'avvenire del Giubaland, e pareri di finanzieri italiani sulla costituzione della società in parola.)

[TRANSLATION.]

IMPROVEMENT OF JUBALAND BY THE FORMATION OF AN ITALIAN-ENGLISH COMPANY FOR DAMMING THE JUBA.

The Juba is a frontier river between British East Africa and Southern Italian Somaliland. From its source (Arussi) to its mouth (Indian Ocean) it has a length of 1,600 kilometres.

Of its course, which is partly torrential, the last section from Bardera to its mouth (290 kilometres in a straight line and 570 kilometres of river course) has the characteristics of a navigable river during several months of the year and is that section which is of interest as regards utilization for irrigation. We give here some data: Depth, 6-8-11 metres; width, 80-250 metres; maximum water level in October and November; minimum water level in March; as regards its water volume (above 700 cubic metres per second at highest water level), it may be considered as yielding *about one-tenth of the Nile*. The situation of the land is most favourable for irrigation, as the river runs through very wide surrounding plains. The land is very fertile and particularly suitable for the *cultivation of cotton.*

The idea of damming the river in order to make use of the waters for agricultural purposes appears to be the most logical one for solving the problem of the improvement of Italian and British Jubaland.

In view of the fact that the river is a frontier, the work could not, and should not, be taken in hand otherwise than by collaboration between Italian and English capitalists. The company should dam the river and carry out all the canalization work necessary to conduct the water to the districts to be irrigated. It might have only an *industrial purpose* (sale of the water to the settlers) or *an industrial and agricultural purpose* (the direct cultivation of the land).

The first task of the company should be a detailed preliminary survey of the district by a committee of experts, who should remain, for some time, on the site to collect all the data necessary for the execution of the final project.

The work once carried out would bring under irrigation *several hundreds of thousands of hectares.*

The initiative for the constitution of the company should come from *two strong financial institutions*; i.e., *an Italian and an English one*, in collaboration.

These institutions should interest their respective Governments in the political agreements necessary and try to obtain facilities and the co-operation of the said Governments in the work intended.

Particulars are given of the presumable economic potentialities of the proposed company; also several English opinions on the future of Jubaland and opinions of Italian financiers with respect to the constitution of the company in question.

MALAYAN RUBBER AND COCONUT SOILS.

By M. Barrowcliff,

First Assistant Chemist, Department of Agriculture, Federated Malay States.

[No abstract supplied by the author.]

THE MANURING OF BANANAS.

By T. C. Brünnich, F.I.C.,

Chemist to the Department of Agriculture and Stock, Queensland.

[No abstract supplied by the author.]

THURSDAY, JUNE 25.—MORNING SESSION.

The Factors which determine Variation in Plantation Rubber, with Special Reference to its Uses for Manufacturing Purposes.

Chairman: THE PRESIDENT.

THE PRESIDENT: We have to deal this morning with a very important subject, "The Factors which determine Variation in Plantation Rubber, with Special Reference to its Uses for Manufacturing Purposes." If you will allow me to do so, I would make this suggestion—that the subject naturally divides itself under three heads. Firstly, we should like to hear from the manufacturers and users exactly what the variations are. Secondly, we should like to hear from specialists, chemists and others, their own experience of these variations in the properties of plantation rubber. Then, lastly, we should like to hear the views of the planters on the general question of these variations, and the ways in which the variations can be avoided. I do not propose myself to say anything at the moment beyond this—that, of course, we all recognize that Para rubber from South America is an exceedingly well established commercial product, which has been sold for a long time in very definite grades. Plantation rubber is a new product from the point of view of the manufacturer, who naturally regards it with suspicion at first. There has been a great deal of misunderstanding about plantation rubber, much of which might be cleared up by a definite discussion as to facts, which I hope is what we shall adhere to to-day. Now having regard to the division I have mentioned, which seems to me the natural division of the discussion, I will ask Mr. Williams, of the North British Rubber Company, to say a few words.

Mr. W. A. Williams (North British Rubber Company): Mr. President and Gentlemen—The question before us has been divided into three headings, and I should like to say a few words about division No. 1, and also to make some reference to our experience as regards No. 2.

In the first place as to the variation itself, and how it affects the manufacturer. Our chief trouble in the factory in handling this grade of rubber is due to the great changes which we have to make in connection with our organization, especially in respect to vulcanization adjustments. We find that the variations in the heat which we have to give the compounds range over a pretty wide figure. I say this not as dealing with any small quantities of rubber, for I may mention that we are using in our factory a very large quantity, and 80 per cent. of our total consumption is plantation rubber. But at the same time we can only use this plantation rubber with a considerable amount of control and careful watching. I will just give you three examples, in order to convey to you some idea of what we have to contend with. The first one is a case where we were manufacturing moulded goods, and the heat varied from 60 minutes at 50 lb. to 70 minutes at 50 lb.—a variation of 16·6 per cent. The next case was one of open steam cure, where the variation was from 2½ hours at 270° F. to 3½ hours at 270° F.—a variation of 40 per cent. In the third case, which took place only within the last fortnight, where we were dealing with wrapped goods, open heated, the heat had to be changed from 40 minutes at 50 lb. to 80 minutes at 52 lb.—a variation of over 100 per cent. I think these instances will show you that there is considerable variation to deal with.

The next question which appeals to us, and on which we have done a considerable amount of work, is as to why this variation takes place. Although this question is more in the hands of the chemists, I think I may be excused for speaking a little on it, as I myself was Chief Chemist to the North British Rubber Company for some considerable time. I think the first thing which occurs to anyone who has experience in dealing with rubber, is that plantations are in the habit, with certain grades, of giving the rubber a considerable amount of working before it is put on the market. I refer particularly to crêped and block rubbers. As a matter of fact, we have now discontinued using these classes of rubbers, and we only use unsmoked biscuits or sheet. We find that the unsmoked biscuits or sheet give just as good results as the smoked, and infinitely better than the crêped and the block. It is rather hard to understand why the plantations should crêpe their rubber. It is a rudimentary principle of the rubber manufacturer that the more you work your rubbers the more you are

going to lose in respect to "nerve" and strength, and I think that any grinding the rubber has to undergo should be left to the manufacturer himself to do, so that he may himself give it the correct condition for putting in his compounds. This grinding, I believe, in many cases is done by machines which even the manufacturer would not use in his factory. They have too high a friction between the rollers, which causes considerable grinding, loss of "nerve," and wear on the rubber, and in some cases this grinding might be carried to such an extent (which is not an unknown thing even in a factory if inexperienced workmen are employed) that vulcanization becomes impossible. Take the finest Para rubber: you may give it such working that you cannot vulcanize it afterwards; and more or less that is what is taking place with the crêped rubbers, and the same, of course, applies to block rubbers. Our reason for not using the smoked rubber is that as regards strength we get no better results. We have a slightly higher washing loss on smoked than we do on unsmoked, and we have a slightly higher resin content. The washing loss is, of course, purely a commercial question, but the high resin content is against the use of smoked rubber for the manufacture of goods against a chemical specification, which is very largely coming into use nowadays; in such cases we find that we are handicapped in having a higher resin content in the rubber.

There is just one other point I would like to mention, and that is in connection with pale rubbers. It has become a practice, and rather a large one, for pale rubbers to be put on the market, and sodium bisulphite is used on the plantations for getting this pale result. As manufacturers we are not interested at all in a pale rubber, and our experience is that the dark rubbers give better results than the light ones. We are now carrying out some experiments in connection with this question of the use of sodium bisulphite. We took some rubber free entirely from sulphur, and we incorporated with this rubber varying percentages of bisulphite, working up to a quarter of 1 per cent., which we found corresponded to a good deal of the rubber delivered to our factory, and in some cases I may say we get up to half of 1 per cent. of bisulphite. We found, on the average results of the experiments, that a quarter of 1 per cent. reduced the stress by 20 per cent., and the strain by 15 per cent., and that the time of vulcanization was increased to the extent of 18 per cent. by one-eighth of 1 per cent. of bisulphite, while a quarter of 1 per cent. of bisulphite increased the time of cure 27 per cent. We carried the experiments a little further in order to find what was the total quantity of bisulphite which would so affect the cure that we should find it

impossible to handle the rubber, and we found that 3 per cent. was the maximum figure. At about that figure vulcanization became impossible.

I do not think there is anything more which I can add at the moment to the discussion, except to bring forward these examples of variations which materially affect our working of plantation rubber.

The President: I think we shall all be agreed that Mr. Williams has given us a very interesting contribution. May I ask whether any other gentleman would wish to speak from the user's or manufacturer's point of view? (There was no response.) Then we will pass to the second division of the subject.

Mr. Spencer Brett (Messrs. Gow, Wilson and Stanton): Mr. President and Gentlemen—This is a subject which has so exercised the minds of scientists that in approaching it I must disclaim all intention of treating it from a strictly scientific standpoint, and in touching upon the various problems involved I wish it to be clearly understood that I hope to offer suggestions only, and that I do not presume to be able greatly to enlighten either the chemist or the planter.

At the outset the very statement that plantation rubber shows excessive variation seems open to argument. It must be admitted that Eastern cultivated rubber has, especially in its earlier years, had to withstand an exceptionally severe ordeal. When the produce of a few isolated trees first reached the market it was examined side by side with a commodity which had been an established commercial proposition for very many years.

Generally speaking, by the time wild rubber reaches the consumers' works it has gone through a variety of bulking, sorting and grading processes, both natural and artificial, and it is evident that in the early plantation days the conditions were most unequal for comparison.

Dealing with the present, we are faced with the fact that the quality of plantation rubber does show variation, and in the interests of the industry every step must be taken to standardize the quality to the utmost extent.

It is now generally known that much of the variation is attributable to differences in any or all of the many details of preparation. It is necessary, however, to go further back than this. A natural variation must exist in the richness and character of the latex as collected from the trees; this again is not only dependent on climatic conditions, but may be directly influenced by the frequency of tapping, elevation or character of lands, length of time during which trees are rested, age of trees, distance of planting and many other considerations.

It follows that in order to reduce the amount of variation in rubber from different estates and districts combined efforts must be made to arrive at the best system of tapping and provide that this system shall be generally adopted. Ceylon has always set a notable example in the very far-sighted way in which her planters have made a practice of comparing notes one with another and thus enabling what has been found to be the best method to be generally employed, and it would be of great advantage if this principle could be followed more thoroughly throughout the East.

It appears to have been found that trees have often in the past been treated with too much severity; the incisions made should be as few in number and as simple in character as possible, in order to economize bark and labour.

Having standardized the method of producing the latex, the next step is surely to reduce the milk thus collected to a standard bulk. A great advance has been made in this direction lately by the introduction by the chemists acting for the Malaya and Ceylon Research Funds of an appliance for quickly ascertaining the proportion of rubber in any latex. It should now, therefore, be a simple matter for every factory, however small, to ensure that the latex when collected shall be reduced to a pre-determined standard strength before coagulation is allowed. Then it has always been impressed upon planters that only the minimum amount of acid necessary to promote coagulation must be used. Strict steps must be enforced to ensure that this is not exceeded.

The fresh coagulum (*i.e.*, the coagulated rubber before the total amount of contraction has taken place) is naturally more liable to damage through rough handling than mature, cured rubber, and it is essential that only so much working in the machine shall be permitted as will effectually reduce the rubber into a form suitable for drying and packing.

Experiments which have been made with thick sheets put once through a hand mangle with only slight pressure go to emphasize the advantage of avoiding harsh treatment of the coagulum in the early stages of preparation.

The two varieties on which plantation rubber has built up its already wonderful reputation are smoked sheet and crêpe. The consumer has now to a large extent familiarized himself with these, and his objections to them and criticism of them have dwindled one by one until very few remain, and he must have either or both of these grades.

It is, of course, most necessary that every possible avenue of experiment should be followed by which any improvement can be effected in the nature of the rubber, but one cannot help feeling that, after working at crêpe and sheet all these years

and having already advanced so far towards perfection with these grades, it would be a pity if too much inventive energy should be diverted from further perfecting them to devising all sorts of appliances for adapting the primitive methods of the forests to Eastern conditions. I allude to the ever increasing number of processes for curing latex by smoke. This research has derived its incentive from the theory that fine hard Para is stronger and more uniform in quality than smoked sheet or crêpe by reason of the method of actual coagulation. Surely this is a slender foundation. It has yet to be demonstrated that the actual process by which fine hard Para is coagulated is responsible for any such access of strength and uniformity, and until such proof is forthcoming it must be premature to abandon our present standards. Any such change would involve all over again a complete unsettling of the consumers' calculations, and he might once more have to set to work by bitter experience to buy his knowledge of still other new descriptions of rubber.

I believe it is a well-known fact that the Hevea latex will only coagulate when acidity is set up. Whether this acidity is imparted to the milk by means of fumes and vapour or by an admixture of acid in liquid form can hardly have any serious influence on the fibre and nerve of the resulting rubber unless excess of acid is used.

The Brazilian Government is said quite recently to have voted a substantial prize or subsidy to a gentleman who has, after years of study, devised a means of preparing Brazilian rubber by a scientific process. The essence of this invention, according to accounts of it which have appeared in the press, is to do away entirely with the use of smoke in coagulation; yet every day almost one hears of *the* machine having been invented, either here or in the East, which will coagulate latex by the direct agency of smoke.

One is constantly asked by planters, "Why do not the manufacturers tell us what they really want?" One feels tempted to reply that it is the planter who has taught and is teaching the manufacturer what he should use, and who has given the manufacturer a product remarkable for its dryness, purity and colour such as was previously undreamt of. The user of rubber in the past had perforce to buy his raw supplies in a dirty, wet, and often putrified condition, and laboriously to clean and prepare them at considerable expense before they were in a fit state for use.

It is obvious that the Eastern industry has enormous economic advantages over all wild rubber areas, and it is equally true that in some departments these advantages are only now beginning to be realized and made use of. We have

been told that fine hard Para as a grade is more stable and even in quality than Plantation Para. I feel convinced that, if only the natural and artificial amenities existing in the East are made full use of, it will not be very long before manufacturers all over the world will have to concede that the grade of rubber to be relied on, not only for purity, colour and dryness, but also for uniformity of quality above all others, is the much criticized cultivated variety.

The premium at which hard Para has stood over Plantation since the latter has been procurable in larger quantities than the former has been used as an argument to prove the inferiority of plantation rubber; but another point which has an important bearing on the question, namely, supply and demand, has been ignored.

For a long time plantation rubber sold on the market at a considerable premium over any other kind, but then its production was insignificant compared with present figures. Meanwhile, the world's requirements of rubber have shown a steady expansion which the supply of Para, being stationary, has quite failed to meet. On the other hand, the rate of increase in the production of plantation rubber has been too rapid for the manufacturers to keep pace with, owing to the short space of time during which they have been able to experiment. There can be little doubt that the comparative shortage of Para rubber, coupled with the phenomenally rapid increase in the plantation supplies, has had more to do with the differences in price than any inherent difference in quality.

We now know that all the ordinary articles of commerce which are manufactured out of rubber can be and are being successfully made from the plantation variety, and considering the short period during which large quantities of plantation rubber have been available, this is a very satisfactory state of things, and it is doubtful whether it could have been arrived at without the stimulus and advertisement which the plantation product received at the hands of consumers through the discount at which it was procurable compared with other grades.

To carry this argument to its logical conclusion, the price for plantation rubber in the world's markets should eventually be higher than that for any other kind of rubber, and we have already experienced hopeful indications of this, the difference in the quotations for Para and Plantation having decreased by over 50 per cent. during the past few months.

To correct what was looked upon as an artificial market manipulation all kinds of proposals have been recently made, those taking the form of standardization schemes being the most prominent.

It was suggested that a rather complicated system of basing

values on chemical analysis should be instituted, but as this appeared to be unworkable it was abandoned.

Manufacturers and buyers will always insist on basing their prices according to their own ideas of value arrived at by expert examination, and in this connection statements made recently by a chemist employed in one of the biggest rubber works in the world are appropriate—he gave it as his opinion that the best way of ascertaining the comparative values of different rubbers is by the trained eye.

To sum up, I am convinced that the producer of cultivated rubber in the East possesses all the conditions necessary to produce rubber more stable in quality than any other, provided his organization is perfected to such an extent as will ensure proper supervision being carried out in every department of collection and preparation.

Dr. Schidrowitz: Mr. President and Gentlemen—I think the first thing we must ask ourselves with regard to the question of variation, or variability, is: How do we define variability? It is quite true that wild rubbers vary, but the variation that exists in them is fairly obvious from their appearance; whereas plantation rubber is all of much the same appearance, and you may have grades which seem the same as regards colour, etc., but which in the process of manufacture turn out very differently. That, I think, is the specific difference between the variation of plantation rubber and of wild rubber.

We have had some very interesting evidence from Mr. Williams regarding the nature of the variation in the factory, and I am glad to see that he confirms the view which I expressed some time ago—a view, I may say, which was based on a great deal of experimental evidence—that the most important factor in regard to variation of the product is its rate of cure. Now in some particulars I agree with Mr. Williams, and in others I dissent from him, and I would ask you not to regard it as entirely presumptuous on my part to differ from an eminent manufacturing expert, because we who are not actually engaged in factories get into more factories, and see more of the general operations in various factories than a specialist who is attached to one individual factory. It is my experience, and I am sure it is the experience of every technologist, that one manufacturer will say that a thing is black, while the next manufacturer will say that the same thing is white; and yet we poor scientists, or technologists, or whatever you like to call us, are told that we know nothing of the practical aspect of affairs, though when we go into the factories of practical men we hear opinions expressed which are diametrically in opposition to one another.

Now I do not differ from Mr. Williams on any essential point, except perhaps in regard to the conclusion as to which grade is most homogeneous, which grade is the least variable, and which grade is most satisfactory. Mr. Williams has told us that they have abandoned any rubber except ordinary sheet and biscuits, and yet he tells us that quite recently they had to alter their heats very considerably—I presume in regard to those particular grades, though perhaps I am wrong as to that. I take it that Mr. Williams's reply to that would be that even these variations are less than the variations of the other grades. Now, so far as my own particular experience goes, it is that smoked sheet shows the smallest variation in regard to rate of cure, also in regard to tensile properties, and also in regard to general mechanical properties. I agree with Mr. Williams that plain sheet is about the best rubber produced when it is good; but my experience, based on a considerable number of samples is, that it varies a great deal more than does smoked sheet. Thus, of some fifty samples, half of which were smoked sheet and half ordinary plain sheet, which were examined, the difference in rate of cure on a single standard basis was: smoked sheets, from one and a half hours to two and a half hours; plain sheets, from one hour to over four hours. In fact, there was one in the latter series which was almost uncurable under the standard basis. At the same time, the best sample of plantation rubber I have ever had, I think, was plain sheet, and perhaps Mr. Williams and the North British factory have been particularly successful in selecting a very good grade of plain sheet. I may say here that a factory such as the North British, or one or other of the great factories in this kingdom, is naturally in a position of great advantage as compared with small manufacturers who cannot have an elaborate scientific testing department; and, as Mr. Williams has well pointed out in his article in the Rubber Exhibition handbook:—

"These troubles, in factories where scientific control is not thoroughly organized, may be sufficient to condemn the use of this grade entirely."

I think, Sir, it is for this reason that the plantation interest should work from every point of view for the purpose of diminishing variability. In making this statement I refer first of all to the work of the planter and the work of the chemist at the other end, and to the work of the manufacturer and the technologist at this end. I refer, in fact, to the question of standardization in its broadest aspects. In making this statement, I wish it to be clearly understood that when we refer to the variability of plantation rubber, particularly as compared with wild rubber, there is no intention to cast a great big stone at plantation rubber at all. The best

plantation rubber is, in my opinion (and when I say my opinion I refer to experimental evidence; I do not merely express a pious opinion), superior to the best grades of wild rubber, as they are used, and can be used, at any rate, by practical men. Here again we come to the question of "working," and I must confess that I prefer to have the rubber rolled or machined while still soft and in a "cheesy" state rather than to have it treated when it is hard and set, as in the case of all wild rubber. I think that if manufacturers would work towards using plantation rubber without washing, if they would make liberal experiments in that direction, they would learn a very great deal. I know a number of factories in this country and in America which use the best grades of plantation rubber without any washing, and I think that therein lies a very great secret. If you do not wash plantation rubber—and it is not necessary to wash a great deal of it, with all respect to certain manufacturers who express a different opinion—you will find that the premier grades of plantation rubber, if you are in a position to select those which are the best, if you are in a position to test their advance or decline, you will find that you get a better result than with the average fine Para. But if you proceed to re-wash your plantation rubber, or if you do not get the best grades, you will find that as a whole the average is not so good as that of the finest wild rubber. Now, Sir, this is a point which I think should be well borne in mind, not only by the manufacturer, but also by the planter. I agree with Mr. Brett that it would be a most retrograde step to send home rubber which is wet, and possibly dirty, which has got to be washed and dried, and treated as all the wild rubbers of the past have been treated. I think there is no greater asset in the plantation industry than the fact that it can produce clean, dry rubber ready for use by the manufacturer. I will go so far as to say that if the rubber manufacturing industry had been founded at the same time as the plantation industry, there would have been no such thing as a washing machine in the manufacturer's plant. I see no reason why every grade of plantation rubber should not be sent home in such condition that it can be used directly. Much more might be done in the way of efficient straining, machining, protecting from dust and dirt than is done. The question of packing, again, is a very important one. We have an article like tea, which is sold down to 4½d. per lb., packed carefully in lead foil; yet we have an article like rubber, which is still selling at appreciably over 2s. per lb. for the best grades, simply thrown into a box and left to take care of itself, the sides of the box consisting of soft wood liberally supplied with splinters; and when it arrives at the docks, as likely as not it

is turned out on to the dirty floor for sampling. Now there is no reason why all this should exist. It would be perfectly simple to pack rubber in such a way—in cloths, for instance—that it should arrive in a fit condition to be used straightaway.

Now, Sir, if I might for one moment look at the question of variability in its scientific aspect, I think we must all agree that the differences, such as they are, can be due first of all to differences in the rubber substance as such, and secondly, to differences in the quantity and quality of the so-called secondary products or impurities. Professor Dunstan, some little time back, told us that chemical analysis was of very little value for the purpose of the evaluation of plantation rubber, and I think I agree with that, and he proceeded to say that the reason was that we had not yet developed a system of analysis which was able to differentiate between the "caoutchouc" present in the various qualities of rubber. In this connection some interesting work has recently been published by Caspari, which revives the theory of two different qualities of rubber in the crude substance, the so-called pectous variety and the so-called soluble variety. This work requires confirmation, but it is well worth following up. For instance, if we could be certain by analysis that all rubbers did contain these two main varieties, and if we could show how much there is in each sample, we might then be able to get over the laborious experimental work connected with vulcanization. At present of course that is out of the question. Secondly, there is the question of the presence of the so-called impurities, of the influence of the resin, of the insoluble matter, of the protein, and so on. In recent years important work has been done on this subject by, among others, Simon, Spence, Weber, and by Dr. Stevens, and it certainly appears that there is some connection between the quantity and the nature of these secondary impurities and the curing properties of the rubber. There is, however, no evidence yet to show that there is a direct connection.

There is one other point on which I should like to make a remark, and it is this: We hear all sorts of opinions expressed regarding the causes of the variations—age of trees, locality, time of collecting the latex, the various operations of the factory, and so on and so forth. Might I say that we should abandon the system of giving opinions on these points, or asking for opinions—that what we want are facts. A number of these points have been worked on by the chemists of the Rubber Growers' Association and other bodies in the East, and they are gradually being elucidated, but it would require very much time to investigate thoroughly all these problems. Meanwhile, might I ask planters, manufacturers and others,

when they express an opinion, to let us know whether that opinion is merely a general and pious one, or whether it is based on direct experimental evidence? I think that nothing has been a more formidable enemy in the past to the plantation industry than expressions of opinion.

Dr. H. P. Stevens: Mr. President and Gentlemen—This subject has been so well covered by previous speakers that very little else is left for me to discuss, and most of my remarks will arise out of statements and opinions expressed by previous speakers.

The other day the General Manager of the North British Rubber Company expressed the view that a great deal of pious nonsense, as he phrased it, has been talked about variation in plantation rubber, and it appears to me that there is a great deal in what he said. Up to now those who have discussed this matter have not appeared to see the necessity of defining what is meant by "variation" and what is meant by "plantation rubber." Dr. Schidrowitz has just given us a definition of variation which I was very pleased to hear, and which, generally, I should like to endorse. Rubber may vary in a great number of ways, and any one of these variations will affect the use of the rubber in the hands of the manufacturer. However, we have not had up to now, apparently, a definition of plantation rubber, and it appears to me that there has been too much confusion as to what is meant by this term. Many people, speaking of plantation rubber, think only of what used to be termed first latex rubber—that is to say crêpe or sheet prepared from latex, while others include in plantation rubber not only the first qualities, but various grades of scrap, which are prepared and worked up in various ways and sent home, forming, perhaps, 25 per cent. of the total quantity. Finally, there are those who would include in "plantation rubber" rubbers coming from plantations on the West Coast of Africa and other places, which is very often not Hevea rubber at all, so that, before discussing the variations of plantation rubber, it is very necessary that we should define what we mean by plantation rubber. Statements have frequently been made that plantation rubber is more variable than Para rubber. Now such statements appear to me extremely unfair to plantation rubber, because in fine hard Para rubber we have one definite variety or grade, whereas in plantation rubber we may have a great variety of grades; and for comparative purposes we must confine ourselves either to all grades or to one particular grade.

Now Mr. Williams has given us the heats of cure of a number of samples of plantation rubber, but I have no doubt he would agree that we could get wider variations if we took

all wild rubbers—I do not say fine hard Para, but all wild rubbers.

The next point I want to speak of is the use of sodium bisulphite. The use of this material is being very severely criticized in various quarters, and as I was largely responsible for the introduction of sodium bisulphite, perhaps I may be allowed to say a few words in defence of this much maligned substance. Now in the first instance sodium bisulphite was used in order to produce a rubber of paler and more even colour. I want to emphasize the words "more even," because it was not merely a question of paler, but of more even colour. We are informed by Mr. Williams this morning, and shall no doubt be told by many other manufacturers, that the question of the colour of rubber is of no importance—that a dark rubber, as he said (and I agree), may be frequently much better than a pale rubber, and that consequently it is a very serious mistake for plantations to use chemicals, even mild chemicals, for the preparation of rubber pale in colour, when such pale colour is not in demand. Now the answer to that is very simple. For quite a long while, and even to some small extent to-day, pale, even-coloured rubbers fetched a better price (it may have been only a halfpenny or a farthing per lb., but still a better price) than dark-coloured rubbers, and naturally enough the planters take means to produce rubbers which fetch a better price in the market.

Now I want to refer specifically to some experiments which Mr. Williams quoted in reference to the use of sodium bisulphite. Firstly, he stated that he had tried mixing small quantities of sodium bisulphite with rubber, and vulcanizing it with such admixture, and that he had obtained results which tended to show that the bisulphite was extremely harmful. Mr. Williams stated, I think, that the maximum amount of sodium bisulphite found in plantation rubber was 0·5 per cent. I hardly think he meant that, because I have frequently examined bisulphite-treated rubbers for bisulphite, and have not detected any, and hardly expected to. The bisulphite can only be detected in the form of sulphate, and some allowance must naturally be made for sulphate being present even in untreated latex. I think, therefore, that possibly Mr. Williams's figures require a little adjustment. Taking the result of these experiments, I do not think it is a fair method—and when I say I do not think it a fair method, I do not suggest that any other course was open to Mr. Williams, but I do not think it a fair method to mix sodium bisulphite with rubber, and then to test it against rubber untreated. It is very different mixing a salt like that with crude rubber, to putting a dose of the salt into the latex in solution. In this connection I want to revert specially

to certain experiments carried out by one of the largest cable manufacturers in this country. They heard about the use of sodium bisulphite, and I got into communication with them on the matter; it was agreed that two cases of rubber should be prepared from one of the plantations in the East, one to be treated by sodium bisulphite and the other not. These two cases were forwarded from the East direct to the Cable Company in question, in order for them to make their tests. A couple of months having elapsed without my hearing anything, I wrote to inquire how these experiments had turned out. They replied that their first tests showed practically no difference in quality between the two, any difference there was being slightly in favour of the bisulphite-treated rubber, and that, being surprised at this very unexpected result, they had repeated their tests very carefully, only to confirm the result of the previous tests. It would appear therefore that this opinion that sodium bisulphite is harmful to rubber is very much open to question. I would point out, firstly, that this firm obtained quite different results from those which Mr. Williams obtained; and secondly, that Mr. Williams's method, although, of course, no other was open to him, is hardly a fair one, and hardly one by which one can arrive at a decision.

I was very glad to hear that many experts now regard the best plantation rubber as equal to fine hard Para. This shows a great change in point of view when contrasted with opinions previously held on this question. There was a time when people would not hear of the possibility of plantation rubber being equal to fine hard Para. Then it gradually came to be admitted that a few samples of plantation rubber had been received which were as good as fine hard Para. Now I think it will eventually be admitted that most of the properly prepared plantation rubber is equal to fine hard Para. Here again I would like to protest against the comparison frequently drawn between plantation rubber as a whole and fine hard Para as one grade, and the best grade, of wild rubber.

There is only one other point on which I would like, I think, to speak, and that is the relative qualities of crêpe and sheet rubber. I quite agree with the view expressed by Mr. Williams, that sheet rubber is better than crêpe rubber, and it is a view which we have always put forward. In the second place I agree with both Mr. Williams and Dr. Schidrowitz that much of the inferiority of crêpe rubber as compared with sheet rubber is due to the machining of the freshly coagulated latex. Of course, the manufacturer, on the arrival of his consignments of rubber, is obliged to put them through the same process as the planter has subjected them to, and it is quite easy to understand how the planter came to use the same

machine. It is obviously easier to clean a freshly coagulated rubber than it is to clean a dry, hardened rubber, in which the particles of dirt and other foreign material have become firmly enclosed; and from that point of view alone I think it is quite easy to understand how the planter came to instal washing machines. Moreover, at that time there was a great deal of talk about putrescible organic matter, the idea being that the purer your caoutchouc, the freer from other ingredients, the better the quality. Of course, these views have changed very much since then. Another point is that I think all planters will agree that the washing machine simplified the process a good deal on the rubber plantations. At the time of the introduction of the rubber-washing machine very little sheet was made; it was mostly biscuits. Now biscuits are small, and the trays in which biscuits are coagulated are of an inconvenient shape, and making biscuits entailed a great deal of handling. Moreover, the biscuits very frequently arrived in a more or less mouldy condition, and consequently there was continued trouble. In the case of crêpe, on the other hand, much of the organic matter was so thoroughly washed out, that if the rubber was efficiently dried it always could be relied upon to arrive home in a clean condition and free from mould. These were the considerations which influenced the planter, I think, in adopting a washing machine and preparing crêpe rubber.

With regard to chemical analyses, I should like to refer to a very recent paper which has been published, and which seems to me to give us a means of carrying further our researches in regard to the protein matter. Reference has been made to the name of Dr. Spence. Dr. Spence is an English chemist working at the head laboratories of the greatest of the American rubber manufacturing companies, and he has recently succeeded in finding an easy means by which protein matter can be readily separated from the rest of the rubber. This is a very promising line of research, and I think when we have separated the protein from different grades of rubber in different ways, and compared the proportion of that protein with the vulcanizing properties of the rubber, we shall quite possibly know more about this particular branch of the rubber industry than we did previously.

Dr. S. Rideal: Mr. President and Gentlemen—I did not come here to speak, but to learn, because I have hardly looked at the subject from the technologist's point of view. It is true that I am interested in plantations of Hevea in the East, and of Ceara and Funtumia, and therefore I know what these trees can produce when planted under known conditions. As a matter of fact, the produce of these three different kinds of rubber trees from estates with which I am personally connected

have been sold in the London market, and practically no difference in the selling price of the product of these three different trees has been discovered. It seems to me, however, that the value of plantation rubber has not been properly gauged in the different markets. Too much value has been attached to the colour and appearance of the product, and too little regard paid to what one may call the physical properties of the product. I think if we could have some method of estimating the actual physical properties of the different kinds of rubber produced we should make a step forward, and therefore I am strongly in favour of standardization in some form, and of plantation rubber being bought and sold upon some test of that character. The variations in the colour of rubber do not seem to be important or essential, and it is very extraordinary to hear the statement of Mr. Williams that pale rubbers, pale Hevea plantation crêpes are not suitable for his work, and that he would avoid their use, whether they were treated with bisulphite or not. It seems to me that a pale sheet or a pale crêpe must be better than some of the darker varieties, although a good many of the darker rubbers are equally as pure as the pale ones. The paleness is determined mainly by the colour of the water used in the washing and the thinness of the crêpe; and even the palest crêpes when bulked together look darker. Sometimes we find that a demand for very pale crêpe has been met by making it thinner, although identically the same as the grade hitherto sold thicker. As to the use of sodium bisulphite, I agree with what Dr. Stevens has said. It seems to me that Mr. Williams's experiments were hardly fair on the use of that reagent. It should not be necessary to use bisulphite in order to produce the pale grade. I have used successfully on one estate formic acid instead of acetic acid, and have found that formic acid has the advantage over acetic acid of being itself a decided antiseptic; the quantity of formic acid used is not greater than that of acetic acid. Of course, coagulation, as pointed out by Dr. Schidrowitz, is determined by acidity, and therefore any acid can be used for bringing about coagulation. Formic acid, however, has the advantage of being distinctly germicidal, and it has the further advantage that if it does undergo any change it passes into carbonic acid and water, and there is no residue in the finished crêpe. The small quantity of formic acid remaining in the crêpe will prevent the growth of mould upon the surface. We have never used bisulphite at all, and have never been troubled with moulds, and therefore I think it is quite possible to produce a pale rubber without the use of bisulphite. It is difficult to see, therefore, why Mr. Williams and his company have such a strong objection to a pale-coloured rubber in the form of

crêpe. If it was a question of physical characteristics there might be something in it—that the thinness of the crêpe, or the working of the crêpe, might have brought about some difference in its physical characteristics which would prevent the vulcanization at the same rate. But, as I understand from his experiments, he abandoned these pale crêpes some time ago in favour of the unsmoked sheet, simply because of these variations in the length of time of the cure. One would like to know how far those differences were really due to the character of the crêpe, or whether they were due to some particular characteristics of the particular experiments he made at that time with the crêpe. I do not think they were due to the crêpe itself as far as I can gather.

Well, Sir, there is one other point which I think is rather important in connection with the problem, and that is, that we should agree to sell on some definite vulcanization test if it can be arranged; and I should welcome any scheme which would ensure this happy result, because, as we have heard over and over again, and we have heard it again to-day, there cannot be any difference between the old form of wild rubber when properly produced and the plantation rubber when properly produced. With regard to the washing, if the planters have taken the trouble to wash the rubber—and we certainly all do wash it now—before it comes to the market, surely that product in itself must be better than an unwashed wild variety, because the impurities have been washed away by the planter, and therefore that product in itself should be worth more than an unwashed sample.

Mr. P. J. Burgess: Mr. President and Gentlemen—I am very much interested in this question of the variability of rubber, and I think we have got to clear up what we mean by variability. At present there is much confusion, and I think we ought to differentiate variability into two kinds—the apparent variability and the real variability. We are rather in the position of egg merchants at present; we are putting a lot of eggs on the market, and we are grading them according to their colour, the kind of hen that produced them, and the dirt there may happen to be upon the egg-shell. But we are not grading them according to the quality of the contents. The only result, of course, is that they are sold and bought simply as a job lot; they may be good inside, and they may be bad inside; that remains to be tested when they are cooked. Now the position is exactly the same with rubber. We are having our rubber put upon the market graded according to its colour, the tree that produces it and its apparent quality, but not according to its real quality, which can only be determined when the rubber has been tested and put through the same

treatment that it will undergo when manufactured. We are assured by many that there is extraordinary variability in the real quality of rubber, and to back up this assurance we have a number of specific, scientific, well-regulated experiments, and there really is no doubt whatever—I do not think anybody can have any doubt—that there is a great variability shown in the real quality of plantation rubber; and we have to get over that in some way or other. I am speaking as a practical producer of rubber. One way would be to produce a rubber which does not vary. Now is that a question of practical politics? All planters will agree with me, I think, that it is not. The estates vary in their equipment from place to place, and it is impossible to ask one company to sacrifice machinery on which they may have spent £10,000 or £12,000. It is impossible to get all rubber turned out in a uniform way; it is impossible to get all rubber prepared, coagulated, or treated in the field in the same way. I do not think, again, it is a matter of practical politics for us to insist upon any agreement at present between the growers of Plantation rubber to do any one thing uniformly. There are too many growers, and there are too many different systems in vogue at present. We cannot ask them all to send their rubber home all alike. How, then, should we go to work to get over this practical question of variability? In my opinion, gentlemen, variability is an advantage to plantation rubber, as long as it is known. It is unknown variability which is the curse. If a manufacturer knew what his rubber would be like, and knew that he would get a certain specific difference in specific grades, the fact of there being so many grades would surely be an advantage. But the difficulty we are labouring under at present is that we do not know where the variability lies. One rubber may be good; another rubber looking like it may be bad. The two are not distinguishable by appearance, and as they are bought by appearance the people who sell naturally suffer. I am sure, gentlemen, our only practical way of dealing with this question of variability is to measure it and disclose it before the rubber is sold.

The PRESIDENT: I do not know whether any of our foreign delegates would like to say anything on the scientific side of the question before we pass to another aspect.

I was going to suggest that it might be convenient at this point to ask Mr. Williams if he has anything to say with regard to the criticisms which have been made on one or two points in connection with his statement.

Mr. W. A. WILLIAMS: Mr. President and Gentlemen—There is one point which I would like to make clear. Judging from Dr. Rideal's remarks, I apparently gave the impression that our reason for discarding crêpe rubbers was owing to

greater variability in this grade. That was not so. Our reason for discarding crêpe rubber was that we found it deficient in strength. We found, roughly speaking, that the variability of crêpe and sheet rubber in respect to vulcanization was about the same, but that the finished product made from crêpe was not so satisfactory as that made from sheet. That was our reason for discarding crêpe rubber.

Another point was raised by Dr. Stevens in respect to the percentage of bisulphite present in some rubbers. As a matter of fact, we tested a very large number of samples, and we did find the percentage which I stated, and it was rather a surprise to us. It came out in rather a peculiar way. We were manufacturing against a specification of sulphur content, and we could not get our goods correct in respect to that percentage. I might say that the average percentage of sulphur present in the rubbers came out at 0·086 per cent. I do not say that it was present as bisulphite; of course, it was almost impossible at that stage to say whether it was bisulphite or not that had been used; it might have been some other sulphur salt. But it was pale rubber, and our experience at the factory has been that with pale rubbers we have had more trouble than with dark ones. The experiment was only put forward more or less as a suggestion that the employment of these salts might be investigated. I do not think there are any other points to which I have to reply.

The President: We have a large number of experienced planters present, and we shall be glad to hear their views.

Mr. G. H. Golledge (Ceylon Planters' Association): Mr. President and Gentlemen—The views expressed by the various speakers this morning are of the greatest interest to us as practical planters—not, gentlemen, as those who take the profits, but as the men who have to produce rubber which will sell on the market at the best price while produced at the lowest figure. The second speaker (Mr. Brett) incidentally put the views of the planters with regard to this subject so ably that I need not again refer to them. This scientific aspect of the question is, as you all know, in the hands of chemists, both in Ceylon and Malaya, who are engaged in research work on the subject, and I have not the slightest doubt that in the course of time we shall get some facts to work upon from the very interesting experiments that are going on; but until we get those facts, and they are supported in the market, you must not expect the planter to produce a thing which he cannot sell. You may, however, be quite certain that the planter will come forward and produce what is needed when he is assured that the market will take what he has produced.

A good deal has been said with regard to the excessive work-

ing of rubber on the plantations, and which is generally called "washing." I think too much stress is put on the word "washing." We do not treat our rubber with the idea of washing it at all; it is more with the object of producing it in a useful form for handling and putting on the market. I do not think it could be called "washing" in any sense of the word from a manufacturer's point of view, although incidentally the rubber does receive a certain amount of washing. I should like to say that recently I met a manufacturer who claimed to have had twenty-five years' experience in one of the largest producing factories, and I asked him that question as to the excessive "working" on estates, and his reply was, "I cannot conceive how rubber treated by machinery on the estate can have the amount of damage done to it which is stated, when I compare that machining with the machining it will get when it goes through our works."

The question of pale crêpe has already been clearly put before you by previous speakers. The palest crêpe is not our cheapest way of producing rubber, and we have always had our own opinion with regard to the lower grades, the darker crêpes. The latter are cheaper and easier to produce, but, unfortunately, they do not command the same price in the markets. Personally, I do not think that it is possible to standardize our first latex, but my experience is that you can if you like produce pale crêpe, of exactly the same kind, from a number of divisions. It has nothing to do with the colour of the water or the amount of water you add to it.

Perhaps I may bring out one point with regard to bisulphite, because it is mostly used in the Malay States and hardly at all in Ceylon. I understand from Dr. Stevens that so far as the cured article is concerned it is not affected in any way by the use of bisulphite. I wish to bring that point out as of interest from the Malay point of view.

Sir Edward Rosling: Mr. President and Gentlemen—I came here to-day as a planter to listen and not to talk, and I very greatly regret that I arrived too late to hear Mr. Williams, because, after all, the manufacturer is the final arbitrator in the matter of rubber. It does not matter very much to us whether the chemist disagrees with the manufacturer or vice versa. The chemist's duty is to assist us to produce a rubber that meets with the approval of the manufacturer.

The position with regard to rubber to-day reminds me of our position in regard to tea twenty-five or thirty years ago. When we first started producing Ceylon tea, we were sending in small lots of five and ten chests. The trade said, "We don't want these little lots; send us three or four thousand chests like we get from China." That difficulty was got over by resorting

to the expedient of mixing the various lots and forming a blend. Now I throw that out as a suggestion on the question of standardization. If the rubber from twelve different estates were mixed, would you not be likely to obtain a more constant product? That is to say, if the rubber from each estate varies, would you not, if you vulcanized them all together in certain definite proportions, get a blend which would remain constant?

As regards crêpe versus sheet, the cheapest form in which a planter can produce rubber is in unsmoked sheets. Smoked sheets cost a trifle more. The origin of crêping was to assist drying, as before artificial drying was introduced it was more difficult to dry sheet rubber. One well-known manufacturer asked me some months ago, "Why don't you produce biscuit?" I said, "Sheet and biscuit are exactly the same; but we can produce sheet cheaper, and incidentally get a rather better price." But I happened to discover that that manufacturer wanted biscuit because he could get it at a penny a pound cheaper. That was very natural from his point of view, and it was equally natural from our point of view that we had stopped making biscuit. The great trouble of the planter, as has been already pointed out, is to learn exactly what the manufacturers want. One manufacturer says he wants crêpe, another says he wants sheet. But all are agreed on the one point, and that is the question of variation, and it is for that reason that as a possible solution I throw out the suggestion that by blending the produce of different estates we might arrive at a common rubber; that is to say, a rubber of constant quality.

M. Emil Baillaud (Marseilles): Mr. President and Gentlemen—I am sorry that some of our French rubber manufacturers are not present at this meeting, because there is a general feeling in France among our big manufacturers that it is not possible to utilize plantation rubber for certain things—for instance, the inner tubes of tyres. There must be some reason for this view, and perhaps it is due to the fact that there are different qualities of plantation rubber. If only the best quality were used, perhaps it would give as good results as the wild Para rubber from South America, which at present they say they must have. I am sorry that French manufacturers are not here to express their views, but I think that when they find they can get good plantation rubber they will use it.

Mr. F. Crosbie Roles: Mr. President and Gentlemen—I think that in many of the references to standardization the matter of greatest practical importance to the great majority of estates is liable to be overlooked. Uniformity is the all-important requirement of the day and of the future, and it is

no solution of the problem to present a series of standards to the producer without at the same time providing a method and system whereby he can accomplish the task of uniformly producing to standard. If a method of production cannot be found that will ensure uniformity of output from individual estates, then central factories will have to be seriously considered, notwithstanding the many drawbacks and difficulties which at present appear to block the way to such a means of surmounting variability. Sir Edward Rosling has suggested that large manufacturers can blend plantation rubber on a large scale, as is done with tea, and doubtless manufacturers are already doing this; but this requires colossal capital, and will tend to keep the manufacture of rubber goods in the hands of a powerful few. Whereas if the producer can supply a uniform article the manufacturing field will be open to many, and both producer and consumer will benefit by plenty of healthy competition.

Mr. G. Stafford Whitby: Mr. President and Gentlemen —I should like to emphasize, if I may, something that fell from the lips of Dr. Schidrowitz. He said that he thought it extraordinarily unfortunate that in the past the discussions which have taken place with regard to the preparation of plantation rubber have been characterized to a large extent by mere expressions of pious opinion rather than by the bringing forward of concrete and definite facts—experimental results. I think it is particularly in regard to the subject which we are discussing this morning, the subject of variability, that such a remark has force, because if one enumerates, one after the other, the factors in ordinary plantation procedure that may possibly affect the quality of the rubber, and that, therefore, may possibly be factors in variability, one cannot but be struck by their vast number; and during the last year, whilst this question of variability has been canvassed so much, the view has been expressed in one quarter that the cause of variability is this factor, and in another that the sole cause of variability is that factor. We have had proposals, for instance, that we should separate our rubber into that produced from trees over nine years of age and that produced from trees under nine years of age, and we are told that if we do that all will be well. Or we are told that if only we are sufficiently careful to standardize the amount of acid used in coagulation all will be well. As a matter of fact, it is impossible to attribute variability to one single factor in that way. The possible factors are very numerous indeed, and I would insist that it is impossible to dismiss on *a priori* grounds as unimportant any factor that may possibly influence the result. What is required in the first place, and what is required fundamentally, is more

investigation, more scientific work in regard to the factors that may possibly be concerned in this matter of variability; and here I would plead that this investigation will hardly benefit—immediately, at all events—any one group of planters or any one association that may be doing scientific work on the subject. We must, I think, if we are to achieve our ends in the shortest time, throw our results into a pool. There must be, at least on such fundamental questions as variability, and of the ultimate factors concerned in the quality of plantation rubber—there must be, if we are to achieve our ends as quickly as we should, an interchange of results between different workers in the subject. There has been in the past, I think, too much secrecy with regard to the conduct of work on these more fundamental issues of the rubber industry. The quality of rubber, the ultimate quality, and its variability, are dependent so far as we know upon such extraordinarily subtle considerations—the character and state of aggregation of the caoutchouc, and so forth—that it must inevitably mean that a large amount of scientific work will have to be done, and will have to be freely exchanged between the different scientific workers, and discussed between them, if we are to put the industry on a stable basis. With regard to the question of how the variability is to be attacked, we have had an extremely interesting suggestion made in recent months for the foundation of a testing station. Now I think, contrary to the remarks of the last speaker, that what is the most urgent and important requirement of the present day in regard to the question of rubber is that we shall get over the question of variability before we begin to direct our attention more particularly to achieve high quality, and it is from the point of view of attacking this question of variability that that testing station will be chiefly valuable at present. When a manufacturer is able, by consulting the figures, to see the results obtained for different lots of rubber at the testing station, when he is able to pick out samples from the monthly or fortnightly returns, and to have before him all the other figures which would be produced according to the scheme which Dr. Schidrowitz laid before the Rubber Growers' Association, when he is able week after week to pick out samples of rubber which he knows will behave exactly in the same way, we shall have done a great deal to attack the question of variability. But also remember, not only must the question be attacked at this end, but it must be very vigorously attacked in the East. It would be a mistake, I think, to lay the sole emphasis on the question of the advisability of selling rubber at this end according to the results obtained at the testing station. We must make vigorous research into the factors concerned in variability, by each

estate trying as far as it possibly can to get its variation strictly uniform day after day, and I will also suggest by shipping the rubber from certain areas together. By that I mean to say that if an estate, let us say, has stations at large distances from the factory, or where there are other possible causes of variation such as that—young areas and old areas, and so forth—that estate of course works its areas in sections, prepares its rubber from this and that section, and keeps it separate in the factory as a rule, but as soon as it goes into the drying shed it is all mixed up together, and the shipment simply consists of the rubber from all those different sections. Surely it would be advisable to make a subdivision of the shipment into parts from different areas, and as far as possible to put each area under one single European, whose duty it would be to see that the processes in the preparation were kept strictly uniform day after day. It is on such lines that the planters in the East must themselves attack the problem. But as I said before, I feel convinced that what we chiefly want with regard to a successful attack on the problem in the East is more information—more facts.

Dr. Warburg (Berlin) also took part in the discussion.

The President: If no one else wishes to speak, I am sure you will wish to give your hearty thanks to those who have come here to-day and expressed their views on this very important matter. I confess that if I were a planter I should feel somewhat confused by the results of the morning's talk. I think that it confirms the view that some of us have held for some time—that what is needed at the present time, as has been said more than once this morning, is more facts; and those facts are only going to be obtained as the result of a considerable amount of laborious and systematic research. I entirely agree with Mr. Whitby that we also need co-operation among the workers. A very large amount of valuable work which is being done at the present time never sees the light of day; that is, it is not made available for general purposes. On the other hand, I do feel that the time is premature for considering what may be called standardization. I am not sure that what I mean by standardization is what some other people mean by standardization, but I cannot see how you can have standardization until you have settled what the standard is going to be, and I think at the present time it is perfectly obvious from what has been said this morning that we are not agreed as to what the standard should be. The first thing to do, therefore, is to settle what our standard for plantation rubber should be, and when that has been done we can put in force some scheme of standardization. Sir Edward Rosling has made a practical suggestion to that end

by proposing the blending of rubbers from large groups of estates, and I think that subject and others might be taken up with a view to securing greater uniformity than at present exists. But these would only be temporary measures, and would still leave open the question of what is the true standard. I think that in many ways more uniformity might be arrived at in Ceylon and in the Federated Malay States with regard to procedure about which we are all agreed, and that would all work towards the desired end. A good deal has been said this morning about the chemical analysis of rubber, which all must agree is still very far from being as satisfactory as chemists would like to see it. We cannot yet assert that chemical analysis alone enables us to judge of the quality of rubber. Our knowledge is not yet advanced enough to enable a proper method of analysis to be adopted, but sooner or later we shall arrive at that stage, and when we do the whole method of examining rubber will be considerably simplified. At present we must have regard not only to the chemical analysis but to the physical properties of rubber, and a very large amount of work remains to be done before we shall be able to come to any definite conclusion. I entirely associate myself with the remarks which have been made as to the distinction to be drawn between opinions and facts, but those who express opinions will excuse themselves, no doubt, for expressing them on the ground that facts are not forthcoming. Until the facts are forthcoming we shall have, of course, to put up with a variety of opinions, and that, I fear, is the present position with regard to many of the problems connected with rubber. I think on the whole we have had a very profitable discussion, and I think it indicates very clearly the advantage which comes from co-operation in such matters between manufacturers, specialists, and planters. The trouble really is that manufacturers are somewhat shy in coming forward and telling us of their difficulties and of their requirements; and we are therefore especially indebted to Mr. Williams for having made such a very valuable contribution to our discussion this morning.

THURSDAY, JUNE 25.—AFTERNOON SESSION,

2.30 P.M.

Section I.—Rubber.

Chairman: SIR EDWARD ROSLING, *Chairman-elect of the Ceylon Association in London.*

THE CHAIRMAN: Gentlemen—We have a great deal of work to get through this afternoon, and I think you all realize that in order to get through it we shall have to limit the papers to a certain length of time—a quarter of an hour—and the contributions to the subsequent discussions to five minutes. I will first call upon Mr. Simpson, the Director of Agriculture of Uganda, to read a paper on *Hevea brasiliensis* in Uganda.

THE CULTIVATION OF *HEVEA BRASILIENSIS* IN UGANDA.

By SAMUEL SIMPSON, B.Sc.,

Director of Agriculture, Uganda.

[ABSTRACT.]

This rubber tree is the one being most largely planted in Uganda at the present time, and coffee is planted as a catch-crop generally.

The tree grows well in height, but slowly in thickness, for two or three years, but then thickens fairly rapidly, and at five years old a girth measurement of 16 in. is fairly common; such trees can be lightly tapped.

The oldest trees in the country are in the Botanical Gardens,

Entebbe, where tapping results have proved fairly satisfactory. On November 14, 1908, tapping was commenced on two trees —one seven years old and the other four. They were tapped for a period of 59 days and gave 4·7 oz. and 4·3 oz. of dry rubber respectively. It was then estimated that 1 lb. of dry rubber per tree per annum could be confidently expected.

Further experiments have proved this, as during 1912, 164 trees were tapped 41 times in the same Gardens, and averaged 13 oz. of dry rubber per tree. The trees were 8 years old, and the methods of tapping were various and entirely experimental.

On January 1, 1913, after the trees in the Gardens had been rested for 9 months, tapping was re-started on 310 trees, and the yield of dry rubber averaged 13¾ oz. per tree to March 31, 1913; during this period the trees were tapped 71 times.

On the Kivuvu Estate in 1913 Messrs. Brown and Hunter carried out tapping experiments on commercial lines, 1,800 trees on an average being tapped per month for four months. The trees were 5 years old, and the method of tapping was one basal V-cut. The average yield per tree for that period was 5·13 oz.

The trees showed no ill-effects from the tapping and were rapidly putting on girth, whilst Mr. Brown informed me that the cost of production on the estate was well under 1s. per lb.

The area under *Hevea brasiliensis* is increasing more rapidly than all the other kinds of rubber taken together.

[Discussion.]

In reply to questions Mr. Simpson stated that *Coffea liberica* was being grown on the Hevea plantations in Uganda, but that speaking generally he was not in favour of planting this variety along with rubber trees; for this purpose he preferred *C. robusta*.

It had been found impossible to grow Castilloa trees successfully in Uganda owing to the presence of a lepidopterous insect which attacks the top shoots and prevents the tree from growing.

Funtumia elastica is indigenous to Uganda and most of the rubber exported from the forests is from *F. elastica* trees. Some of the planters started to grow this species in plantations, but it takes so long to come to maturity, and the yield of rubber is so small, that it is hardly advantageous from the planters' point of view. They have therefore given up Funtumia entirely and are now sticking to *Hevea brasiliensis*.

ON SOME ANIMAL PESTS OF THE HEVEA RUBBER TREE.

By E. Ernest Green, F.E.S., F.Z.S.,
Late Government Entomologist, Ceylon.

[Abstract.]

The paper describes such animal pests of Hevea as have come under the writer's personal observation in Ceylon, and briefly notices other pests of the plant that have been recorded by various observers in other countries.

Such records are remarkably few, and it may be assumed that the Hevea tree is still exempt from any serious or widely spread animal pests.

This comparative immunity may be due partly to the protective nature of the viscid latex that exudes profusely when a healthy tree is wounded, and partly to the small number of years during which the plant has been under cultivation.

Where possible, recognized methods of control have been indicated.

[Discussion.]

Mr. G. Stafford Whitby: Mr. Chairman and Gentlemen—With reference to the author's remarks on the function of latex, which is of particular interest to myself, I am very much inclined to agree with his position that one, at least, of the functions of latex is that it serves as a protective agent against the attacks of insects. In that connection I might draw attention to one fact which is not generally appreciated, and that is that the latex, as we are acquainted with it on the estates—that is, latex obtained from the trees by regular tapping after wound response has set in—is very different in its tendency to coagulate from the latex which exudes when a Hevea tree is first punctured. In the latter case the latex coagulates almost instantaneously, but afterwards the latex may, and in fact does, remain in a liquid condition for several hours; and it is the latex present in the tree before any tapping has gone on that we have to consider in respect of the function of latex in regard to insect defence. Of course, I do not think that is the prime function of latex, but I certainly think it is a function. I was given a very interesting instance on that point some time ago by a planter who found that some of the tobacco pests got on to his rubber trees, but they were never able to get inside. They were always stuck there as soon as they had made an incision; the latex exuded, and coagulated, and kept them there. There is one other point I might perhaps

mention, and that is with regard to the edibility of latex. Mr. Green mentioned the case of some molluscs that were able to drink latex, and says he considers that this is perhaps some slight evidence in favour of the idea that caoutchouc is not actually present in latex as such, but that there is some other material present from which the caoutchouc is formed. I rather question whether that is sound evidence, because, if I may put it to Mr. Green, would it not be the fact that the digestive juices would coagulate the latex?

CEARA RUBBER CULTIVATION AND MANUFACTURE IN SOUTHERN INDIA.

By Rudolph D. Anstead, M.A.,

Planting Expert and Scientific Officer to the United Planters' Association of Southern India.

[Abstract.]

(1) Ceara Rubber (*Manihot Glaziovii*) is chiefly cultivated in Mysore State, the Shevaroy Hills, and Coorg on a plantation scale. It was introduced about 1880 as a shade for coffee, but it proved too dense and was cut out. About 1900 experiments were begun with it as a commercial source of rubber, but incorrect methods of tapping were employed, and the idea was abandoned. This difficulty has now been overcome, and since 1904 Ceara has been extensively planted. There are now some 3,000 acres of it in Mysore, 2,000 acres in the Shevaroys, and 12,000 in Coorg.

(2) Most of the experimental work of recent years has been carried out in Coorg, which is well suited to this variety of rubber, as the Ceara tree can withstand considerable periods of drought, and as a second string to coffee it appears to have excellent prospects.

(3) Like other crops, it responds to good soil and cultivation. When first planted these points were neglected, and to this the original failures were largely due. It is important that when the tapping age is reached 80 to 90 per cent. of the permanent trees should be tappable.

(4) It is usual to plant the trees closely and afterwards to thin them out. This is done by taking out all the weak trees; the resulting irregularity of space does not matter.

(5) When the trees are four to six years old they are ready to tap, and two systems are adopted with young trees: (1) a herring-bone system, making a fresh cut at each tapping; (2) a vertical system. Older trees can be pared, the bark having

reached a sufficient thickness for the purpose, and a herring-bone system is then adopted. If care is taken not to wound the cambium the bark heals quickly and well.

(6) The process of manufacture is simple. No acid is used, but coagulation is done with hot water in a dark room, and the quality of the resulting rubber is improved by slow coagulation. After coagulation the wet rubber is rolled and washed. This variety contains a large amount of resin and washing must be prolonged. It is finally made into sheet, a diamond roller usually being used, and dried. Some smoked sheet is manufactured. In Coorg three factories are equipped to handle the latex from the estates.

(7) The yield is smaller than from Hevea. An average yield from six-year-old trees is ⅝ lb. dry rubber per tree in 40 tappings. This can be put on the market at a good profit.

(8) The Ceara tree is found to be very variable as regards yield of latex and rubber, and new clearings are now being planted with cuttings from selected trees with the idea of improving the yield.

(9) Manurial experiments are in their infancy, and it is as yet too soon to say anything definite about results. There appears to be a tendency for nitrate of soda and possibly potash salts, applied just before tapping, to increase the latex yield.

(10) Diseases are few, the most important being a root disease caused by a fungus, but this is controllable by removing jungle stumps before planting, and by digging out and burning affected trees as soon as they are noticed.

(11) It is not recommended to grow Ceara in preference to Hevea rubber in districts suited to the latter; but in the hill districts, with a rainfall of 70 to 80 inches, where Hevea will not flourish, there is every reason to believe that Ceara will prove a valuable crop, especially in conjunction with coffee.

THE CULTIVATION OF *MANIHOT GLAZIOVII* IN UGANDA.

By Samuel Simpson, B.Sc.,

Director of Agriculture, Uganda.

[Abstract.]

This rubber grows exceedingly well in Uganda, and was largely planted up to two years ago. The average girth is from 19 to 20 in. at three years of age and when ready for tapping.

A large number of experiments in tapping have been carried

out on the Government Plantation, Kampala. The trees were arranged in groups containing twenty each, with an average girth of 15 in. to 20 in., whilst the system of tapping was the half herring-bone, paring and pricking being employed.

Each separate group was tapped a certain number of times, varying from 10 to 90, and the yield obtained from the trees was in practically direct proportion to the number of tappings. However, in order to obtain $2\frac{1}{4}$ oz. of dry rubber per tree, no less than 90 tappings had to be made.

The trees are in a thriving condition and bark renewal takes place fairly rapidly, so that no ill-effects of the tapping are evident.

At this low yield there is nothing left for European planters after paying for the necessary labour, but for native cultivators, with the product at a normal price, the returns are just profitable.

The area under *Manihot Glaziovii* is not increasing.

Trials have been made with the allied Manihots (*M. dichotoma*, *M. piauhyensis*, and *M. heptaphylla*), but these are less satisfactory as regards growth, and the trees are so brittle that they suffer severely from every wind storm.

No tapping has been done on the allied Manihots, but I see no reason to hope for any better returns than have been obtained from the *Manihot Glaziovii*.

[Discussion.]

The Chairman: Has any member any questions to ask or any remarks to make on either of the two Ceara papers which have just been read?

Mr. P. J. Burgess: I should like a little more information as to how coagulation is done with hot water.

Mr. Anstead: The latex is simply poured into the tin, mixed with warm water, and allowed to stand ten or twelve hours at the ordinary temperature, which in our districts is about 72° F. We use water at about 90° C. to 95° C. to begin with, and it rapidly cools down. The latex coagulates perfectly simply by itself, as long as you keep it in the dark.

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): I have listened with much interest to the two papers we have just heard, one from Southern India and one from Uganda. I am very much inclined to agree with Mr. Simpson as regards the profit to be made out of the Ceara rubber tree in Africa. In Nyasaland we have something like 14,000 acres under Ceara rubber, which has been planted every

year for the last ten years, and we in Nyasaland, like our friends in Uganda, are beginning to abandon the cultivation of this variety. The tapping of Ceara rubber in my experience is very much influenced by the rainfall. In Nyasaland we have two very distinct seasons—a very wet, rainy season, and a dry season. During the dry season the Ceara tree casts its leaves. For the first months of the wet season it is putting on new foliage, and if you try to tap it then the work is practically futile. From numerous experiments the best results I have had with Ceara rubber is a yield of under 4 oz. of rubber per tree, and I find the profitable tapping season in Nyasaland is only three months. The consequence is that the cultivation of Ceara rubber hardly pays in Nyasaland, and it is not surprising that the planters as a body should abandon its cultivation. There is one spot in Nyasaland where Ceara gives results like those mentioned by Mr. Anstead. We have a rainfall in that part of Nyasaland of something like 70 in. per annum, spread evenly throughout the greater part of the year. In that district Ceara rubber does well; but the conditions there are equally favourable for *Hevea brasiliensis*, and a comparison of tapping expenses, to produce a pound of Hevea rubber and a pound of Ceara rubber, leaves a good deal in favour of the Hevea tree.

Professor P. Carmody (Director of Agriculture, Trinidad): These two papers are really very interesting, one being an account of the successful cultivation of Ceara, and the other an account of an unsuccessful attempt. I would like to know from Mr. Anstead what is the nature of the soil and what is the rainfall in Southern India, and how that contrasts with the conditions under which Ceara trees have been grown in Uganda.

Mr. Anstead: There is very little doubt that the success or non-success of the cultivation of Ceara rubber depends almost entirely on climate. That is why in Southern India it is only in a few districts that any attempt is made to grow it. The three districts in which we have cultivated it successfully are Coorg, the Mysore State, and the Shevaroy Hills. There we have light soils, and it is my experience of Ceara that it needs a lightish sandy soil, and will not grow successfully in heavy clay. Again rainfalls are light with us; we have 70 in. in a year, which is hardly anything at all, because on our Hevea rubber estates the rainfalls run up to 250 in. and come at two periods of the year. In the particular districts where Ceara is grown, there are periods when we get the heavy north-east monsoon, and then we get 50 in. or 70 in. of rain, distributed over four weeks. The rest of

the year we have more or less dry weather. Now that is what Ceara seems to like very much indeed. Our tapping season is, as a rule, in the normal season, divided into the two different periods of the year following the two rains. Under other conditions I should not expect Ceara to be a success, and from what I have heard I certainly should not expect it to be a success either in Nyasaland or in Uganda.

The President: Perhaps Mr. Anstead would kindly tell us if these districts which are so successful for Ceara are suitable for Hevea. Have you been trying it under the same climatic conditions as those under which Hevea would succeed?

Mr. Anstead: No; we only grow Ceara in Southern India at high elevations where Hevea would be impossible. That is why we are anxious to push on with Ceara, because we can grow it and get rubber in districts where we could not possibly grow Hevea.

Mr. Simpson: I think Mr. Anstead's paper is a very interesting one. I noticed in the abstract he says, "It is not recommended to grow Ceara in preference to Hevea rubber in districts suited to the latter"; and that is exactly the condition of things in Uganda. The Ceara rubber we do get is very good rubber, and there is no difficulty in selling it, as manufacturers seem to like it. But we cannot get the yield we want, and our position is this: If we can grow a rubber which gives a better yield than Ceara, what is the good of bothering with Ceara? Mr. Anstead's position is this—that they have an area where Hevea cannot be successfully cultivated, and where they want to grow some other crop. I think it is very creditable to the planters of Southern India that they should be making a success of Ceara rubber.

Mr. C. E. Welldon: I should like to ask whether after continuous tapping you do not find a very considerable mortality amongst your Ceara trees?

Mr. Anstead: Not at all. We are tapping on the new plan, and we find no ill-effect. We tap very carefully, and avoid touching the cambium if possible. Accidental wounds are treated at once with some antiseptic to keep out insects and fungi, and under those conditions we have no difficulty whatever.

Mr. Welldon: Do you not touch the cambium when doing vertical cuts?

Mr. Anstead: No, you tap just so that you do not.

Mr. Simpson: What kind of instrument do you use?

Mr. Anstead: It is like an inverted V made slightly round, or an ordinary farrier's knife with one of the edges kept very sharp. As a matter of fact it does not matter about the knife itself; it is the man behind the knife.

LE CRITÉRIUM TECHNOLOGIQUE COMME BASE DES MÉTHODES DE SÉLECTION DES PLANTES CAOUTCHOUCIFÈRES ET DE PRÉPARATION DES GOMMES.

Par M. le Professeur HEIM,

Secrétaire perpétuel de l'Association scientifique internationale d'Agronomie coloniale et tropicale.

[No abstract supplied by the author.]

NOUVELLE MÉTHODE D'ANALYSE DU CAOUTCHOUC BRUT, ET ÉTUDES SUR LE MÉCANISME DE LA COAGULATION DES LATEX.

Par M. MARQUIS,

Chef de Travaux à la Faculté des Sciences de Paris.

[No abstract supplied by the author.]

[DISCUSSION.]

Mr. P. J. BURGESS: Mr. Chairman and Gentlemen—In connection with these papers I would like to draw attention to a little experiment made some years ago dealing with the filtration of latex. Previously to that it was not generally recognized that ordinary latex can be filtered and a clear serum obtained. I am simply reminding this meeting of the fact because I think it might perhaps be a starting point for further experimental work, and it appears to me to present an avenue which might have prospects, because it would be such a simple way of separating the liquid in which the globules are suspended without in any way chemically altering the liquid. A further interesting fact is that if that liquid be acidified a precipitate is formed of some protein matter, which is possibly acid albumen. I am simply making the suggestion for the benefit of any chemists who are now prosecuting researches on this subject.

The PRESIDENT: The fact that Mr. Burgess has alluded to is well known, but for some reason or other we have not succeeded in the last few years in getting much further light upon the exact nature of coagulation. As Mr. Burgess is aware, the original idea was that the protein contained in the serum was really the cause of the coagulation of the rubber, but that idea must now be abandoned as a theory, and we have I think, to look in another direction altogether for an explanation of the phenomenon.

THE METHODS OF TAPPING CULTIVATED CASTILLOA TREES IN TRINIDAD AND THE YIELD OF RUBBER THEREFROM.

By Professor P. Carmody, F.I.C., F.C.S.,
Director of Agriculture, Trinidad.

The method most in favour in Trinidad and Tobago for the tapping of Castilloa trees requires no lengthy description. The implements used are a chisel with a specially thin cutting edge about 1½ in. wide, and a wooden mallet. Every other method has been tried, including paring and puncturing.

Cuts are made along the trunk about 12 in. apart vertically. Other series of cuts at about 4 in. to the right and left are made, and these are continued right round or half round the tree as high as can be reached on foot or on ladders.

The chisel is pointed slightly upwards so that the bark on the upper edge of the cut may protrude slightly over the lower edge, and prevent the entrance of rain. Clean cuts should be made, and each cut should slope slightly downwards from the horizontal to facilitate the collection of the latex. The proper depth of the cut is easily ascertained after a short experience.

It depends on the condition of the trees, and the length of the intervals between the tappings, whether the latex will flow from, or coagulate on, the cuts. If it coagulates on the cuts, the best course is to make a ball of the rubber direct from the tree, stretching the rubber as much as its strength will allow. This stretching appears to improve the rubber.

The latex when plentiful may be collected in cups, or in any other convenient receptacles, and the rubber immediately separated from it in a centrifugal machine, or more slowly by creaming and setting in shallow trays with porous cloth bottoms. Coagulation may be hastened by the addition of diluted acetic or sulphuric acid, or an aqueous extract of the "moon" vine (*Ipomœa bona-nox*).

In Trinidad and Tobago Castilloa has not been grown as a separate cultivation. It was recommended some thirty years ago as a shade tree for cacao, and it has been tried for that purpose only over small areas. Under these conditions it has not given, and could not be expected to give, the best results; and the yield of rubber from our trees may be considerably less than that from trees grown under different conditions. The best results that have been obtained in Tobago from young trees tapped for the first time to a height of 20 ft. for half the girth of the tree are for an average of ten trees 10·8 oz., and for 288 trees a little over 5 oz. for a single tapping, and 3·4 oz. for a second tapping four months later.

A special chisel, made by Mr. Jowett at the suggestion of the author of the paper, has been successfully used in Trinidad, and a specimen was shown at the meeting.

THE METHODS OF TAPPING CASTILLOA RUBBER TREES IN MEXICO AND THE YIELD OF RUBBER WHICH THE TREES FURNISH.

By Ashmore Russan,

Director of the Soconusco Rubber Plantations, Ltd.; London Director of La Zacualpa Plantation Company.

[Abstract.]

The paper deals:—

(*a*) With the cultivation of Castilloa rubber on La Zacualpa and other plantations in the District of Soconusco, State of Chiapas, Mexico, and also with a plantation in the State of Oaxaca, Mexico.

(*b*) With the methods employed in tapping cultivated Castilloa rubber trees in Mexico and the tapping-knives used.

(*c*) With the yields of rubber obtained on a commercial scale from cultivated trees of different ages, and with the reputed yields from wild trees.

(*d*) With the yield of cultivated Castilloa rubber trees in comparison with that of *Hevea brasiliensis*, and shows why the Castilloa may be more suitable for cultivation in Mexico than *Hevea brasiliensis*, owing to the deficiency of labour.

(*e*) With experiments which have been made to increase the production, and points out that, in the author's opinion, this can only be done by better cultivation.

(*f*) With the different species of Castilloa to be found in Mexico and Central America from the point of view that the Castilloas are all of the same species, and that the difference in yield, etc., is probably due to environment.

[Discussion.]

Sir Thomas Holdich: Mr. Chairman—I can add nothing really valuable to what Mr. Russan has said. In regard to Mexico, no one can speak with such authority as he can. But with reference to the varieties of the Castilloa tree, I would like to ask Professor Dunstan whether such varieties of Castilloa occur. I have seen it stated, though I cannot say positively where, that no less than seven different kinds of Castilloa are

found in Mexico. It may be as Mr. Russan has said, that the same seed under different circumstances will produce a somewhat different tree. I am not agriculturist enough to know whether it can be so or not, but it strikes me it is a very important thing for us who are interested in rubber in Mexico to know whether there are varieties of Castilloa, some of which may be accepted as much better yielding trees than others, or whether there are not.

The Chairman: Mr. Russan, I think, held that it was a question more of environment than of actually different varieties.

Mr. Russan: Yes.

The President: I have hardly any doubt there are several varieties of Castilloa, but whether they have ever been examined as to their yield of rubber I do not know.

Mr. Russan: They may have differences of structure, but the differences come from environment; I am quite sure of that.

CONTRIBUTION POUR L'ÉTUDE DES PLANTATIONS DE CAOUTCHOUTIERS À ANGOLA.

Par le Professeur C. de Mello Geraldes,

Directeur du Laboratoire de Technologie Coloniale et du Musée Agricole Colonial de l'Institut Supérieur d'Agronomie, de Lisbonne.

[Abstract.]

L'auteur a résumé dans ce mémoire quelques renseignements à l'égard des plantations de caoutchoutiers d'Angola.

Il commence par renseigner que la culture des plantes caoutchoutifères a commencé son développement à Angola, spécialement à partir de 1911, c'est à dire lorsque la fabrication de l'eau de vie fut défendue par décret.

Il présente ensuite quelques statistiques relatives au nombre de plantations de caoutchoutiers, qui existaient à Angola en 1913, et au nombre d'arbres dont elles étaient composées.

On peut conclure d'après son examen, que c'est au nord d'Angola, surtout, que la culture des caoutchoutiers s'est développés plus largement.

Il décrit ensuite sommairement les procédés de culture, de l'extraction du latex, et la préparation du caoutchouc en usage dans quelques plantations, et il indique les caractéristiques des

échantillons provenants des plantations d'Angola qui existent au Musée Agricole Colonial de l'Institut Supérieur d'Agronomie de Lisbonne. En finissant son étude, il présente quelques considérations et quelques conclusions, qui le portent à assurer que: —

D'après l'enthousiasme des agriculteurs d'Angola, qui poursuivent dans la plantation des caoutchoutiers, quoiqu'ils ne doivent pas en attendre les prix élevés, que le caoutchouc a atteint autrefois, et grâces aux efforts du Gouvernement, d'accord avec ceux du Bureau d'Agriculture d'Angola, pour le développement de l'agriculture, que cette colonie dans quelques années deviendra un centre important de production de caoutchouc.

L'espèce *Manihot Glaziovii* est celle que l'on cultive principalement.

Les saignées en général sont faites par séries verticales de *ponctions*. Chaque série a environ deux mètres de longueur. Les incisions sont faites à l'aide d'une sorte de "pricker" inventi par le planteur d'Angola M. Santos.

Le rhytidome est arraché du tronc avant la saignée des arbres. Le latex est recueilli en godets, et généralement versé dans des plateaux creux en bois, ou *en fer émiallé*, où il coagule spontanément. Ensuite le caoutchouc est comprimé, pressé et séché.

Dans quelques plantations on lave le caoutchouc, et aussi dans quelques-unes on enfume le caoutchouc pendant le séchage.

Les caoutchoucs des plantations d'Angola sont présentés sous la forme de *feuilles* et de scrap. Ils obtiennent des cotations assez élevées et pas éloignées de celles des caoutchoucs de l'Amazone et des plantations de l'Orient.

[TRANSLATION.]

CONTRIBUTION TO THE STUDY OF THE RUBBER PLANTATION IN ANGOLA.

The author has summarized in this memoir some information regarding the rubber plantations in Angola.

He begins by stating that the cultivation of rubber-yielding plants has developed in Angola especially from 1911 onwards, that is to say since the manufacture of spirits was prohibited by decree.

He then presents some statistics recording the number of

rubber plantations existing in Angola in 1913, and the number of trees of which they consisted.

It may be concluded from his discussion that it is mainly in the north of Angola that rubber cultivation has been most widely developed.

He then describes summarily the methods of cultivation, extraction of the latex, and preparation of the rubber in use on some of the plantations, and he indicates the characteristics of the samples obtained from the Angola plantations which are in the Colonial Agricultural Museum of the Higher Institute of Agronomy at Lisbon. In concluding his study he offers some considerations and conclusions to the effect that:—

Owing to the enthusiasm of the agriculturists of Angola, who continue the planting of rubber trees although they cannot expect the high prices which rubber has realized in the past, and thanks to the efforts of the Government, in agreement with those of the Bureau of Agriculture of Angola, for the development of agriculture, this colony will become in a few years an important centre of rubber production.

Manihot Glaziovii is the species which is mostly cultivated.

Tapping is generally carried out by vertical series of cuts. Each series is about 2 metres long. The incisions are made by means of a kind of "pricker" invented by a planter in Angola, M. Santos.

The outer cortex is pulled from the trunk before the trees are tapped. The latex is collected in cups and generally poured into hollow wooden or enamelled iron trays, in which it coagulates spontaneously. Then the rubber is squeezed, pressed and dried.

On some plantations the rubber is washed, and also on some the rubber is smoked during the drying.

Plantation rubbers from Angola are offered in the form of sheets and scrap. They realize fairly high prices, which are not much inferior to those of rubbers from the Amazon and the Eastern plantations.

The CHAIRMAN: Gentlemen—Our time is exhausted, and I think we must take the other papers as read, although, of course, they will be duly published. I am extremely sorry to have had to hurry some of the papers, but, as you see, our time is very limited. Personally, I am very grateful to the readers of the different papers, as I am sure all the other members are. It has been a most interesting afternoon, and although some of us would have liked a little more time for discussion, yet none of us, I think, can leave here to-day without feeling that we have been dealing not only with matters of interest, but of education.

The following papers were taken as read:—

THE PRINCIPLES OF HEVEA TAPPING AS DETERMINED BY EXPERIMENT.

By T. Petch, B.A., B.Sc.,
Government Botanist and Mycologist, Ceylon.

[Abstract.]

The early tappings of Hevea in Botanic Gardens and Experiment Stations were made simply to determine whether the trees would yield rubber, and, if so, how much. This phase is no longer necessary, and at the present time tapping experiments, which should, as far as possible, be conducted on virgin trees, should be designed to obtain further data on some definite problem. The experimenter should not be deterred by the criticism that his tapping problem is "purely academic"; our knowledge of rubber tapping would have been in a far more advanced stage to-day if previous experiments had been restricted to "purely academic" problems.

The first attempt to ascertain the fundamental principles of Hevea tapping was made in Ceylon in 1898 by Parkin, who used single-incision methods only. Parkin was followed in the Federated Malay States in 1901-2 by Arden, who also worked chiefly with single-incision methods, but in some experiments adopted an "excision" method in which the reopenings of the cuts were limited to fourteen. The ideas obtained from these experiments have practically governed Hevea tapping until quite recently, although they were founded on quite a different form of tapping to that now adopted. Dr. A. W. K. de Jong has recently carried out fresh experiments in Java on some of the questions dealt with by Parkin and Arden, using modern methods of tapping, and his results afford a scientific foundation for the consideration of the problems involved. The experiments were conducted as a rule for a period of eight months, and it is pointed out that this may be a possible source of error in some cases; it is desirable at present that comparative tapping experiments should, with few exceptions, be carried on until the available tapping area has been completely tapped.

The paper reviews the results obtained in various tapping experiments, with special reference to the different factors which are now known to influence such results, viz. (1) The area of the tapping surface; (2) the direction of the tapping cut; (3) the distance between the cuts; (4) the number of cuts; (5) tapping intervals; (6) the use of the pricker. The defects of the recorded experiments are pointed out where necessary,

and indications given as to the further experiments which are required in order to decide specific questions. It is considered that at present the greatest scope for tapping experiments lies in the direction of "change-over" systems, in which different sides of the tree are tapped alternately for periods of two or three months.

In conclusion it is urged that full data should be given in connection with all tapping experiments, as in many cases insufficient information is supplied; accurate diagrams would furnish much of the information required.

DISEASES OF HEVEA IN CEYLON.

By T. Petch, B.A., B.Sc.,

Government Botanist and Mycologist, Ceylon.

[Abstract.]

Though *Hevea brasiliensis* has been cultivated in the East for more than thirty years it has acquired few diseases, and the majority of them are not serious.

The most important diseases in Ceylon at the present time are Brown Root disease (*Hymenochaete noxia*), Pink disease (*Corticium salmonicolor*), Dieback (*Botryodiplodia theobromae*), and Canker (*Phytophthora Faberi*). The production of nodules and the decay of the tapped cortex are serious phenomena which have not yet been traced to fungus agency.

SPOTTING IN PLANTATION RUBBER DUE TO FUNGI.

By A. Sharples,

Assistant Mycologist, Federated Malay States.

[Abstract.]

Spottings in plantation rubber are due chiefly to common saprophytic fungi. Though the spot-producing fungi are common saprophytes, the number of different spottings appears strictly limited. Most of these fungi belong to the genera Penicillium and Aspergillus.

The investigation indicated that latex is an unfavourable medium for the growth of fungi. But to produce spot under ordinary conditions, the fungi must germinate quickly and grow vigorously, therefore it is most probable that these fungi produce enzymes capable of rendering food material in the latex readily available. These enzymes are probably proteo-

clastic, acting on the proteins in the rubber, and rendering them immediately available for the fungi. The fact that the majority of fungi fall in the two genera mentioned above supports the view that these fungi are probably rich in enzymes.

The spottings can be prevented by adding 1 part of formalin to 800 parts of latex, the formalin inhibiting the development of the spores, so that the rubber is dry before the fungus has enough time to produce visible spots. Sodium bisulphite is also useful as a preventive, probably due to its influence in inhibiting enzyme action.

Latex diluted with water results in rubber with a greater tendency to spotting. The results obtained in this connection are concordant with the experience of many planters troubled with spotting.

External inoculation after preparation can only take place under extraordinary conditions of retardation of the drying period. Under ordinary conditions of drying there is no danger to be anticipated from spores falling on the surface of the rubber after preparation.

THE PREPARATION OF PLANTATION PARA RUBBER.

By B. J. Eaton,

Agricultural Chemist, Federated Malay States.

[No abstract supplied by the author.]

TERMES GESTROI AS A PEST OF THE PARA RUBBER TREE.

By H. C. Pratt,

Government Entomologist, Federated Malay States.

[No abstract supplied by the author.]

INCREASING THE YIELD OF FUNTUMIA BY THE SPARANO TAPPING METHOD IN THE BELGIAN CONGO.

By M. Gisseleire,

Colonial Office, Brussels.

[Abstract.]

The plantations of *Funtumia elastica,* the Ireh or Lagos rubber tree, have given, as a rule, unsatisfactory results, the yield being much smaller than that obtained from Hevea.

However, as the Congo State has planted a number of Funtumias, experiments are still carried on in order to improve the system of tapping.

The different methods recommended in other colonies have been tried in the Government plantations: the Schulze im Hofe system (vertical incisions); the full herring-bone (15 to 20 ft. high); the Christy system (pricking on the herring-bone pattern).

A new method has been devised by M. Sparano, one of the Congo Government Agriculturists. It is similar to the Christy method, but the full herring-bone is not made in one operation; the tapping is completed in nine or ten days, a few new laterals being traced every other day.

The trees seem to stand this tapping very well and yield heavily, the yield in these experiments being twice the amount collected by the ordinary herring-bone, and four times the yield of the Schulze method.

KAUTSCHUK-ANBAU IN DEN DEUTSCHEN KOLONIEN.

Von Dr. Fritz Frank,

Kautschuk-Zentrastelle für die Kolonien, Berlin.

[Abstract.]

Referent schildert die Verhältnisse, unter welchen in den deutschen Schutzgebieten Kautschuk angebaut wurde und angebaut wird. Er zeigt, dass ausser den jeweils heimischen Gewächsen auch die unter anderen Verhältnissen heimischen Kautschuklieferanten sich anpassen und verweist hier auf die plastischen Beispiele aus Kongo und Goldküste. Man hat dort die Hevea zum Teil auch unter Neiderschlags-Verhältnissen, welche unter 2,000 m. liegen, heimisch machen können und nach einigen schwierigen Jahren ungünstiger Entwicklung den örtlichen Verhältnissen angepasst befunden.

[Translation.]

RUBBER CULTIVATION IN THE GERMAN COLONIES.

The writer describes the conditions under which rubber is being and has been cultivated in the German Protectorates. He points out that, besides the original indigenous plants, rubber-yielding plants which are native under other conditions also become acclimatized, and he refers in this connection to the examples from the Congo and the Gold Coast. There they

have succeeded in acclimatizing Hevea partly also under unfavourable conditions, at an elevation of 2,000 metres; and, after a few years of difficulty and unfavourable development, in getting it accustomed to local conditions.

APPRÉCIATION DE LA VALEUR INDUSTRIELLE DES CAOUTCHOUCS D'APRÈS LEURS PROPRIÉTÉS MÉCANIQUES.

Par M. Chèneveau,

Chef de Travaux à la Faculté des Sciences de Paris.

[No abstract supplied by the author.]

NÉCESSITÉ POUR L'INDUSTRIE DU CAOUTCHOUC DE LA DÉTERMINATION PRÉCISE AU LABORATOIRE DE LA VALEUR RESPECTIVE DES CAOUTCHOUCS.

Par M. Lamy-Torrilhon,

Président de la Chambre Syndicale des Fabricants de Caoutchouc.

[No abstract supplied by the author.]

THURSDAY, JUNE 25.—AFTERNOON SESSION,

2.30 P.M.

Section II.—Cereals and Sugar.

Chairman: SIR H. HESKETH BELL, K.C.M.G., *Governor of the Leeward Islands.*

THE CHAIRMAN: Gentlemen—Owing to the unfortunate illness of Sir Louis Dane, who was to have taken the chair at this Section, the honour of presiding over this meeting has been entrusted to me.

As you will see by the programme, we have a considerable number of papers on the agenda for this sitting. Some of them, however, will be taken as read, as the authors are not present. The first paper will be read by Mr. A. E. Humphries, who is so well known as a practical miller. He is a Past President of the National Association of British and Irish Millers, and was formerly Chairman of the Home-Grown Wheat Committee.

THE PRODUCTION OF WHEAT IN THE TROPICS.

By A. E. HUMPHRIES,

Past President of the National Association of British and Irish Millers.

[ABSTRACT.]

The quantity of wheat produced in tropical countries is relatively unimportant. In some of these countries wheat is indigenous, and in those cases interest centres on the efforts of scientists to supplement the empirical knowledge acquired by many generations of growers; in others it is exotic, and the story of the difficulties encountered, the efforts made, and the success achieved in introducing and adapting wheat to entirely new environments is full of interest.

The author passes in rapid review the quantities produced in the tropical countries of North and South America, Africa, Asia, and Australia, and then refers in summarized detail to

the recent agricultural and scientific work concerning wheat done in Rhodesia, British East Africa, tropical and sub-tropical Australia, tropical India, and the Sudan.

Temperate climes are the habitat of wheat, and pioneers in new countries have hitherto sought to give it such environment, even in the tropics, but very large areas of good land are available for the production of wheat, if varieties can be found or produced, which will thrive on a small rainfall, or if irrigation can be provided on a large scale. Everywhere rust is the enemy, and the application of recent botanical discoveries, more particularly the researches of Professor Biffen and others as to the inheritance by plants of immunity or susceptibility to disease, are likely to increase greatly the area upon which wheat growing can become a profitable commercial proposition.

The author also refers to the efforts made to improve the milling and baking qualities of wheat. He specially directs attention to such results obtained in India, where Mr. and Mrs. Howard, using as parents varieties indigenous to the country, have by hybridizing produced new ones of greatly superior quality, which are likely on European markets to realize relatively higher prices, fully equal to those obtained for the best Canadian and American kinds.

The yield of grain per acre is small not only in the tropics, but in most countries, and by the production of varieties, each one in the highest degree suitable to some environment, the yield of wheat per acre, and therefore the total crop of the world, can be greatly increased.

The CHAIRMAN: Gentlemen—The next paper on the agenda deals with a somewhat cognate subject, namely, that of "The Indián Grain Trade." It is written by Mr. Frederick Noël-Paton, the Director-General of Commercial Intelligence in India, who is, unfortunately, unable to be here this afternoon through illness. In his absence we are fortunate to find that the paper will be read by Sir James Wilson, who is himself an authority on the same subject.

THE INDIAN GRAIN TRADE.

By FREDERICK NOËL-PATON,
Director-General of Commercial Intelligence, India.

[ABSTRACT.]

Areas under food-grains in India. Magnitude. Constitution of statistics. System of forecasts. Production value. The mass of the food-grains retained in the country. Conditions

of storage in India. Causes of damage. Rains supervening on harvest. Damp and heating. Weevil. Drying as remedy. Forced sale. Spasmodic exports and traffic. Attendant disadvantages. Congestion and glut. Effect on trade movement and prices. Desirability of adopting methods accepted in other countries. Principal export grains: rice and wheat. Large growth in shipments of secondary grains: barley, "gram," maize, millets, &c.

The CHAIRMAN: Before we proceed to the discussion on the last two papers I shall call upon M. Emil Baillaud, of the Colonial Institute of Marseilles, whom we are glad to see with us, to read his paper. He also is an expert on grain, and, as I understand, has interested himself largely in the possibilities of grain traffic and export from the French Colonial Possessions in Africa.

LES BLÉS D'ALGÉRIE ET DE TUNISIE ET LEURS SÉLECTIONS.

Par M. EMIL BAILLAUD,

Secrétaire-Général de l'Institut Colonial de Marseille.

[No abstract supplied by the author.]

[DISCUSSION.]

The CHAIRMAN: I am afraid I must ask those gentlemen who will be good enough to speak in the discussion concerning the three papers which have been read to limit themselves to a few words, much as we should like to hear them at greater length.

Mr. S. K. THORPE: Mr. Chairman and Gentlemen—I have listened with much interest to Mr. Noël-Paton's valuable paper, and look forward with much pleasure to reading it, when one will have more facility to digest the valuable information which it contains.

In view of the increasing importation to this country of barley from India, I wish Mr. Noël-Paton had given us more information which we know he must have on the production and exportation of this cereal, particularly as barley which was formerly imported from India for feeding is now almost entirely imported for brewing purposes. When we consider that two years ago this country used something like one and a half to two million quarters of barley for brewing, the production of the best varieties for the purpose and the handling and exportation of the grain in such a manner that it will not be

impaired for brewing purposes is a matter of considerable importance.

I can readily understand that a change in the method of transporting grain in India from the present system to one based on an elevator system, combined with official grading, would have many advantages, particularly as regards railway carriage, but a number of other advantages, attached to an elevator system, would be lost (as regards exportation) if the grain had to be sacked when transferred to the steamers, and it is improbable that the grain would carry in such good condition in bulk as it does in sack.

As regards barley for brewing purposes, the three greatest drawbacks at present are:—

(1) Weevil.

(2) Heating.

(3) Dirt and impurities.

Weevil.—I think this evil would be minimized if barley could be stored in country elevators where it could be readily moved from one bin to another, if it remained in store for any length of time. I do not think the shipping of barley in bulk would be advisable on account of the conditions being more conducive to weevil development.

The whole conditions prevailing in India are peculiarly favourable to weevil development, and it is not practicable to reduce the moisture in barley to 4 or 5 per cent. in order to make it immune from weevil.

Heating.—If barley could be placed in proper storage, as soon as threshed and delivered by the ryots and zemindars, no doubt the damage by heating would be reduced to a minimum; but while Indian barley is liable to contain anything from 4 to 30 per cent. of dead, decayed and heated grain, which will not germinate, it will only be used for the lowest class of malting barley, and at prices less than Californian, Oregon, Smyrna and Mediterranean brewing barleys.

Dirt and Impurities.—Indian barleys are rapidly improving in this respect, and with the continued use of the grain for brewing this defect (which was very bad two and three years ago) is already working out its own remedy.

Mr. A. E. HUMPHRIES (*contributed after the meeting*): I wish to enter a caveat on two points arising out of that part of Mr. Noël-Paton's paper which has been read.

Provided any wheat is used for some special purpose, the demand might be easily in excess of the supply at some given period, and such a wheat may then realize a relatively much higher price than it would do if there were a slightly or substantially larger supply. Mr. Noël-Paton pointed out that most of the Indian wheat is exported soon after harvest, and

apparently wants to draw the conclusion, taking into account the fact that higher prices for Indian wheats have prevailed at Indian ports during the later part of the season, that if the exports were distributed more evenly throughout the entire cereal year relatively higher average prices would be obtained for Indian wheat.

There is a substratum of truth in the idea, but it must not be forgotten that the value of wheat exported from India depends on the world's market, and not only on Indian prices, and it does not follow if the shipments were more evenly distributed throughout the year that the extra price obtained would correspond to the increased price which has been obtainable in the later part of the year for Indian wheat at Indian ports, nor must it be forgotten that the earlier shipments of Indian wheat are substantially superior in quality to the later shipments of the same crop.

Furthermore, it must not be assumed that the shipment of Indian wheat in bulk is desirable, or that it would be acceptable to British millers. The proof of the point is very meagre, but it seems that wheat which is susceptible to damage by weevil should be shipped in bags and not in bulk, and that the small saving in transit due to handling in bulk may not compensate for the risk of damage.

The Chairman: I will ask Sir James Wilson to say a few words in winding up the discussion.

Sir James Wilson: Gentlemen—I very much regret that Mr. Noël-Paton has been unable, owing to illness, to read his valuable paper himself, but I may say that I am in general agreement with his conclusions. I should have liked, if there had been time, to have gone into some of the questions which he has raised, especially concerning wheat, because I have myself been studying that subject. I will, however, say only a word or two about the work which Mr. Humphries has done for India. He has helped us enormously in India by carefully analysing, testing and reporting upon the different varieties of wheat in that great country; and it is very interesting to hear the good account he gives of the new varieties of wheat which our experts there, especially Mr. Howard, have been so successful in raising We hope that in a short time we shall be able greatly to increase the quantity of wheat produced, and improve the quality over a considerable part of that area.

Mr. Thorpe referred to the question of barley, and I ought to explain that in reading the paper, owing to the need for brevity, I omitted that part which deals with barley. I think that on reading the paper when it is printed he will find there is considerable information on that subject which will be useful

to him. India exports only a comparatively small fraction of the grain she produces, and we have to think, first and foremost, of the needs of the natives, the Indians themselves. There need be no fear that the Government of India will always do this; they will first consider the people of India and their needs. At the same time we want to help the grower who does produce grain for export, to get as good prices as possible for his product; and we want to encourage the people to grow the sort of grain that is required in this country. This action will at the same time benefit the people in India in so far as it also improves the quality of the grain for their own consumption.

The following papers were taken as read: —

RECENT WORK IN AUSTRALIA ON THE IMPROVEMENT OF WHEAT.

By F. B. Guthrie, F.I.C.,

Chemist, Department of Agriculture, New South Wales; Lecturer in Technology, Sydney University.

[Abstract.]

After a short introduction dealing with inter-state action for the encouragement of the study of wheat with the object of its improvement, the qualities which are to be specially looked for in wheats to be grown under Australian conditions are discussed in some detail, and the results so far obtained in effecting improvement in these qualities are reviewed. The work done in the several States both by individuals and by the Institutions under State control are next dealt with more fully.

New South Wales.—Several of the Farms and Colleges are largely concerned with experimental work in connection with wheat. There is one wheat-breeding station where the propagation of new varieties is carried out by means of cross-breeding and selection. The new varieties are then tested at the farms in different districts, and the suitable ones grown on a large scale and distributed to farmers for seed.

Notes are given on the operations in progress at Cowra (the wheat-breeding station), and some of the more promising new wheats are discussed.

A list of varieties recommended by the Department for different districts is given. Other means by which the Department encourages wheat improvement are by means of farmers'

experiment plots, where variety and manurial trials are carried out by the farmers themselves, and by the Agricultural Bureau System.

The operations of the wheat-testing mill of the Department are also touched on, as well as the official connection of the Department with the Chamber of Commerce and with the judging of wheats at the Agricultural Society's Show.

Victoria.—Systematic work in cross-breeding and selection of wheats is carried out at several of the Colleges and Farms under the direction of the Department of Agriculture. Standard varieties are grown in stud-plots for distribution as seed wheat to farmers.

Farmers' experiments are also carried out with the assistance of Departmental officers, and variety and manurial tests are conducted. An experimental mill is in operation where the milling qualities of new and of established varieties can be tested. This is also used in connection with the agricultural show.

The work done at the Agricultural College at Dookie in the production of new varieties by cross-breeding and selection is discussed, and the more striking and promising of the newer wheats are described.

South Australia.—It is pointed out that South Australia was the first State where wheat breeding was taken up, and this before the establishment of Government Farms and Colleges. The names of two or three of these pioneers are mentioned and their more important productions discussed. Several of these wheats are still great favourites, and they have been used by subsequent breeders as parents for new varieties.

The plan in successful operation at Roseworthy Agricultural College of " continuous selection " is dealt with and details of the method explained, by which it has been found possible to keep up the desired qualities by systematic selection. In addition to this College the Department has a special wheat-research station where cross-breeding is carried on. Three or four other experiment farms under the Department are largely devoted to experiments with wheat.

South Australia was the first State to institute the Bureau scheme mentioned above under New South Wales, and this has been found to afford a considerable encouragement to wheat improvement, both as regards varieties and soil-management.

Western Australia.—The work of one or two of the earlier wheat breeders is noticed, and the varieties which they created discussed. The work of wheat breeders in this State has been chiefly confined to selection. The work of the last few years

is reviewed, and particularly some interesting results obtained in the production of new varieties by natural cross-fertilization.

There are several experiment farms under the control of the Department of Agriculture, three or four of which are specially devoted to wheat culture. In addition, the Education Department has made wheat growing a subject for Nature-study in the schools.

In this State, also, a small wheat-testing mill has been established, where new varieties can be milled and the flour tested and baked into loaves.

Queensland.—As this State is not, at present, an extensive producer of wheat, less attention has been given to wheat breeding. Some of the earlier work in connection with diseases in wheat is dealt with. The Department of Agriculture, however, encourages experimental work in wheat, and two or three of the farms devote a considerable amount of attention to wheat experiments. Seed wheat true to type is grown for farmers, and a wheat-testing mill is in operation.

The paper closes with a discussion of the possible future extension of the area on which wheat growing can be carried on profitably in Australia.

THE PRODUCTION OF MAIZE WITH SPECIAL REFERENCE TO SOUTH AFRICA.

By Joseph Burtt-Davy,

Botanist, Agricultural Supply Association, Ltd., Johannesburg, South Africa.

[Abstract.]

It is not, perhaps, generally realized that the world's annual consumption of maize is greater than that of wheat, actually 447,000,000 bushels more. At the same time it takes only one-half of the acreage sown with wheat to produce the same quantity of maize; in other words, maize yields twice as much per acre as wheat, and is therefore the cheaper crop to produce, other things being equal. In addition to this, the maize crop yields a larger quantity of highly nutritious stock-food, in the form of "stover" (dry stalks and leaves), than is the case with wheat or any other farm crop grown, excepting, perhaps, sugar cane and the sorghums.

The world's annual consumption of maize grain is about 3,929,000,000 bushels. This grain is used as food for man and his domestic animals, and also as a source of supply of alcohol, starch, glucose, dextrin, corn oil, glycerine, cellulose, and

other commercial products. New uses are constantly being found for maize products, and the demand is rapidly increasing.

The markets of Northern Europe are at present supplied chiefly from the United States, Argentina, and South-east Europe. The combined consumption of these countries is gradually absorbing more and more of the surplus formerly available for export; this year (1914) the United States of America, which produces 75 per cent. of the world's maize crop, has begun to *import* from Argentina for her own domestic requirements. The large purchasing markets are now looking for new sources of supply. The author points out that at present the whole of the African Continent contributes only about 1 per cent. of the total world's production, but that it might grow much more, and concludes that as a field for maize growing British South Africa is the most suitable and most promising undeveloped agricultural area of equal size in the whole world. He then discusses the advantages of South Africa for maize production.

The climatic and other peculiar requirements of the maize crop, improvement by breeding, and the methods of treatment in South Africa are then briefly discussed, as also are the local diseases and pests, varieties and breeds, and local methods of handling and exporting the crop.

The author concludes with an appeal for the immigration into South Africa of capable, trained farmers, with £1,000 to £1,500 capital, to develop the maize industry in conjunction with stock-farming.

BURMA RICE.

By A. C. McKerral, M.A., B.Sc.,
Deputy Director of Agriculture, Southern Circle, Burma.

[Abstract.]

It is pointed out that although Burma has only 10,000,000 acres under rice, as compared with 50,000,000 acres in Bengal, it exports no less than 75 per cent. of the total quantity of rice shipped from India. This is due to the fact that its population is small in comparison with the rice acreage, so that there is a large surplus of rice for export. Though the available area for rice has now been almost entirely taken up in Burma, there are still possibilities of increasing the output by irrigation and by intensive cultivation, so that there seems to be no reason to expect any falling-off in the Burmese exports in the near future.

Rice is cultivated in Burma both in the Deltaic Region, with a rainfall of 70 to 200 inches per annum, and in the Central Region with the low rainfall of 25 to 35 inches per annum. In the second of these areas rice is a crop of secondary importance, except where irrigation is possible.

Apart from manurial and other experiments having for their object the introduction of improved methods of cultivation, the Department of Agriculture in Burma is carrying on experiments for the improvement of the rice grain. The chief objects of these experiments are:—

(i) The elimination of red-grained and awned varieties of rice.

(ii) The production of grain which shall be free from awns and red skin, and shall be of uniform size, vitreous in appearance when husked, and spheroidal rather than cylindrical in shape.

(iii) The avoidance of dirt and foreign seed in shipments of rice.

This work is being done at the Mandalay and Honwabi Experiment Stations, and a brief description of the methods followed is given in the paper.

The CHAIRMAN: We now pass on to the important subject of sugar. The first two papers dealing with this subject will be read by Dr. C. A. Barber, and a third by Mr. G. E. Bodkin.

THE SUGAR CANE IN INDIA.

By Dr. C. A. BARBER,

Government Sugar Cane Expert in India.

[ABSTRACT.]

The native canes of India are mostly different from those in the tropics. Two great regions of cane growing in India, differing widely in character and importance: (1) Peninsular India with 250,000 acres; the varieties chiefly introduced tropical ones, and the cultivation practically as in tropical countries; limiting factor water; difficulties of extension. (2) North Indian Tract, not in the tropics; 2,000,000 to 3,000,000 acres along the foot of the Himalayas from Assam to the Punjab; soil and water good; limiting factor warmth; cultivation poor, and varieties inferior; conditions of growth throughout the year; the growing season short and the adaptation of the canes to it by rapid growth; the unsuitability of the North Indian Tract for thick, juicy canes.

The reasons for the existence of this large acreage under sugar cane, where the conditions are unfavourable. The fate of attempts at providing sugar-making factories in North India and the prospects of success in the future. A great increase in the importation of white sugar during recent years. Government assistance in improvement of sugar manufacture and the class of canes grown. The latter alone dealt with here.

The only available method the raising of seedlings. Hitherto unsuccessfully tried in India. The rarity of cane flowering in North India and popular superstition regarding it. The infertility of the stamens in cane flowers in North India. Flowering much commoner in South Indian canes and the stamens fertile even in introduced North Indian canes. Hence a cane-breeding station started in Madras. Seedlings raised in numbers, but most of them from introduced tropical parents, although many native canes collected and grown at the stations. North Indian canes desired as parents; the character of these and the gradual decrease in luxuriance towards the north-west, where the canes become very primitive. The need for crossing the canes of each tract with rich tropical canes. Some of the results thus far obtained at the cane-breeding station.

THE CLASSIFICATION OF INDIAN SUGAR CANES.

By Dr. C. A. Barber,
Government Sugar Cane Expert in India.

[Abstract.]

For the improvement of the Indian sugar industry it is necessary to obtain a thorough knowledge of the canes of the country. The existing descriptions of these are very meagre, but several collections of varieties have been made and preserved in Government Farms. The classification of these varieties is practically pioneer work. The method adopted has been to make an exhaustive study of each variety as it has been met with, to note the differences between them and to build up a classification upon these.

Classification according to habit is a very useful starting-point. Erectness, leaf-endings, tillering, selected for brief consideration.

Colour of use, but less suitable for main classes; colour of stem, blushing, colour of leaf-sheath, colour induced by fungi —all useful minor characters.

Joint, a portion of a cane stem from node to node. Enormous number of variations in one or other of its parts—leaf-scar, bud, root-zone, growth-ring, bloom-band. Select leaf-scar and bud for more detailed study.

Leaf-scar: its orientation, horizontal or descending; mode of embracing stem; circlet of hairs; scar-band, scar-line, etc.

Bud: epitome of vegetative shoot; shooting, bursting, size and shape; point of origin; flanges; vestiture, etc.

The founding of a natural system on these and other characters too numerous to mention. An analytical key not aimed at, but a system founded on natural affinities. The magnitude of the task without the aid of floral characters. Four natural groups at present evolved: Chin, Rheora, Pansahi, Nargori. A summary of the characters of three of these groups.

The general primitiveness of Indian canes and the similarity of the Chin group to *Saccharum spontaneum*.

THE INSECT PESTS OF SUGAR CANE AND THEIR CONTROL IN BRITISH GUIANA.

By G. E. Bodkin, B.A., Dip. Agric. (Cantab.), F.Z.S., F.E.S.,
Government Economic Biologist, British Guiana.

[Abstract.]

Insect pests of sugar cane have been known in British Guiana for at least the last quarter of a century, but it is only during more recent years that they have received any serious attention and combined efforts have been made for their control.

The most injurious pests are those known collectively as "Borers," which consist of three distinct species of lepidopterous larvæ, namely, a member of the Castniiadae (*Castnia licus*, Fab.) and two species of Pyralidae (*Diatraea saccharalis*, Fab. and *Diatraea canella*, Hps.). Other important pests consist of Termites popularly known as White Ants, of which there are two species, *Eutermes costaricensis*, Holmgr. and *Mirotermes nigritus*, Silv.; the larvæ of the Noctuid Moths, *Laphygma frugiperda* and *Remigia repanda;* the Mealy Bug, *Ripersia* sp.; and the Weevil Borer, *Metamasius hemipterus*, Linn.

A number of these pests are attacked by several kinds of hymenopterous parasites, especially the Small Moth Borer, *D. saccharalis*, whose eggs are infested by the well-known *Trichogramma minutum*, Riley.

Native-born East Indian children are employed for the control of these pests, each estate maintaining a gang of from thirty to as many as one hundred individuals. The Giant Moth Borer (*Castnia licus*) is destroyed by searching the stools, etc., of recently cut canes and thus securing the grubs. The adult insect is also captured by means of hand nets. During 1913 as many as 1,374,878 grubs and 597,503 moths were thus destroyed.

The Small Moth Borer attacks the cane principally during the first four months of its growth, penetrating the interior of the young shoot and destroying the growing point. This causes the central shoot to die; those plants with a dead shoot are cut off close to the ground, split open and the contained grub or chrysalis of the Borer secured. During 1913, 25,583,987 caterpillars were thus destroyed. The gangs are invariably paid by results, a halfpenny apiece being paid for the Castnia grubs, and 4d. a hundred for the small Borers; these prices of course fluctuate according to the abundance of the pests. The collection of the eggs of the Small Moth Borer has recently been commenced on some plantations, also the artificial breeding and distributing of egg parasites.

Termite nests are now invariably removed from the fields by the weeding gangs; by this means their numbers are kept within bounds.

The Chairman: Gentlemen—We will now bring this Section's proceedings to a close by conveying your thanks to Dr. Barber and Mr. Bodkin for the very interesting papers which they have read to us.

The following papers were taken as read:—

PALMS AS A COMMERCIAL SOURCE OF SUGAR.

By H. E. Annett, B.Sc.Lond., F.I.C., F.C.S.,
Agricultural Chemist to the Government of Bengal.

[Abstract.]

The paper brings to notice work which is being done by the author in India and by Gibbs in the Philippine Islands on the native industry of the production of sugar from palms. About 500,000 tons of sugar are annually produced from this source.

The species of sugar-producing palms are enumerated, together with a short account of the methods of sugar production. Data are given as to the amount of sugar present in the juices and of the yield of sugar per tree and per acre.

The advantages and disadvantages of palms as a commercial source of sugar are set out, and it is concluded that if properly managed the industry might have a great future.

SUGAR PRODUCTION IN THE NORTH-WEST FRONTIER PROVINCE, INDIA.

By W. Robertson Brown,
Superintendent of Agriculture, North-West Frontier Province,

and

Dr. J. W. Leather,
Imperial Agricultural Chemist, India.

[No abstract supplied by the authors.]

THE SUGAR INDUSTRY OF QUEENSLAND.

By H. T. Easterby,
General Superintendent of Sugar Experiment Stations, Queensland.

[No abstract supplied by the author.]

THURSDAY, JUNE 25.—AFTERNOON SESSION, 5 P.M.

Chairman: Sir H. Hesketh Bell, K.C.M.G., *Governor of the Leeward Islands.*

The Chairman: Gentlemen—It is due to an unfortunate circumstance that I have the honour of presiding over this meeting. Sir Louis Dane was to have done so, but he has, unfortunately, been taken ill. I am sure everyone here will join with me in wishing him a speedy and complete recovery. We are going to have the pleasure now of hearing a paper by Mr. Frank Shuman on "The Utilization of Sun Power for Irrigation and other Purposes in Tropical Agriculture." Mr. Shuman has had a very long experience in regard to this fascinating subject, and I am sure he will explain it to us in a most interesting manner.

THE UTILIZATION OF SUN POWER FOR IRRIGATION AND OTHER PURPOSES IN TROPICAL AGRICULTURE.

By Frank Shuman.

Although unlimited power is daily thrown to the earth by the sun, it is only lately that a practical means of utilizing this power has been discovered. It is not generally known that the unconcentrated rays of the tropical sun will boil water, but such is the case, and in order to obtain power of any required amount, it is only necessary to collect sufficient sunlight and throw it upon a boiler.

By concentrating the sun's rays it is possible to obtain sufficiently high temperatures to melt the hardest metals, steel having been thus melted, and also a sixpenny-piece in seven and a half seconds. But such high temperatures are not necessary for power purposes, and in the sun-power plant described only five concentrations are used. The solution of the problem of producing mechanical power from the sun's

rays has only been solved after seven years of patient experimental work and the expenditure of very large sums of money.

An experimental plant was erected at Cairo in Egypt, this position being chosen on account of its convenience, as it was desired to use the plant for demonstration purposes. As the fuel cost absolutely nothing, the question of mechanical efficiency did not require to be taken into account. It was a question altogether of construction, upkeep and labour; and if the interest on the capital added to the cost of upkeep and attendance was so high as to cancel the profit made by not requiring fuel, then there was no incentive to go further in the matter.

However, the results of tests of the plant had been very satisfactory, and it was estimated that power could be produced in the tropics at the same cost as if coal were less than 10s. per ton, and as coal in many parts of the tropics costs £2 10s. per ton and upwards, the saving to be effected by means of sun-power plants is quite obvious. Although sun-power plants cost more than coal-burning plants, the saving effected by not requiring any fuel is sufficient to wipe out the extra capital cost after two years, and to pay entirely for the plant in four years.

The steam produced from the rays of the sun is exactly the same as that obtained from the burning of any fuel, and therefore the power can be used for any purpose whatever. The engine is a low-pressure reciprocating condensing engine, and the pump an ordinary reciprocating pump. Experience has shown that steam at atmospheric pressure gives the greatest return in power per pound sterling invested, and therefore the engine runs on steam supplied at this pressure. The steam is generated in five absorbers 13 ft. wide and 200 ft. long, which are parabolic troughs for catching the sun's rays on mirrors and throwing the rays on to a boiler swung at the focal point. The rays are absorbed by the black surface of the boiler, and the heat is sufficient to generate large quantities of steam. The absorbers are placed with sufficient clearance so that they do not shade each other in the morning and evening. They rotate on a system of gearing in such a manner that the mirrors point directly towards the sun at all times of the day, and the correct adjustment is effected by means of a thermostat operated by the sun itself. The steel framework of the absorbers is designed in such a manner that it can be manufactured very cheaply, and as each piece is very light, the question of transportation is not a serious one.

Sun-power plants in this system can be built of any size up to 10,000 h.p. if required, and will work for ten hours per

day or longer, depending upon the latitude in which they are placed.

The Cairo plant gave sufficient steam to produce 50 b.h.p. for ten hours per day, and had it been located further south it would have given probably 65 b.h.p.

The absorbers are constructed to withstand all the wind of the tropics, whilst the mirrors are set in spring frames so as to avoid any risk of breakage and can be cleaned by washing with a hose. The power generated by the rays of the sun can be stored so as to keep up the supply of power during the whole of a rainy day or through the night by means of storing heat in boiling water, and the engine has been designed to work economically on this system, which is in extensive use in America.

Sun-power plants occupy a large area, but in places where they will be installed in the tropics land is very cheap indeed, and the ground rent of a sun-power plant will be only a fraction of that of a plant of equivalent size in any of the manufacturing centres of Britain.

All the materials used in the construction of this plant are of the simplest kind, and therefore the cost of upkeep is very slight.

There is a large field all over the tropics for sun-power plants where fuel prices are high and where land at present is not irrigated owing to the excessive cost of fuel and the absence of surface water. Sun-power plants could be built to meet the immediate requirements, and then be added to as the population increases. In this way there will be an enormous saving.

Sun power, of course, is independent of any combination of capital or labour. Every year coal and oil become more expensive, and as time goes on it will, therefore, be better and better for sun power.

An area of 143 square miles in the Sahara Desert covered with sun-power plants would furnish as much power as that produced by the whole of the coal and oil supply of the world, and as much heat as would be produced by the combustion of our entire store of coal and oil is thrown to the earth by the sun in three years.

The lecture was illustrated by means of a cinematograph film showing the plant at Cairo at work.

[Discussion.]

The Chairman: Gentlemen—Of all the large number of admirable papers delivered at this Congress within the last three days, I am sure none has attracted greater attention and

interest than the paper which has just been read by Mr. Frank Shuman. It almost seems presumptuous to think that we can make a servant of the sun, but Mr. Shuman has described so clearly the way in which he proposes to take such a liberty with the sun—and, in fact, has already done so—that one is certainly inclined to think that even if he has not already solved the problem he is, at all events, on the verge of an immense discovery with unlimited power for good. The possibility of using the sun as a producer of heat and energy on this earth opens up a vast vista of possibilities, and the clear way in which the lecturer has described his process must have made most of us think we were hearing of something almost too good and too simple to be true, and we wondered perhaps why it had not been done before. But we know that the most simple things are often thought of last. You have all listened to Mr. Shuman's exposition with close attention, and I am sure his kind consent to answer questions will be taken advantage of by many present.

Mr. E. E. Green: May I ask what the cost would be for one of the smallest installations?

Mr. Shuman: Well, roughly speaking, it would be about £31 per horse power. You could practically build installations down to 5 horse power, but of course it would be better to have one central plant of more convenient size, and then transmit electric power to the small places round.

Sir J. Wilson: I know parts of India where we sometimes want irrigation considerably more in the cold weather than in the hot. In the places I have in mind the sun is not nearly so powerful as we are accustomed to think of it in connection with India; in fact, it is only a little hotter than it is in England in the summer. Would this method be able to develop any useful power in such a case as that?

Mr. Shuman: That is a very interesting question. As I point out in my paper, the sun does not throw heat rays on the earth; it simply throws light rays, and unless these light rays are absorbed no heat is produced. It is not a question of atmospheric temperature so much. If a sun-power plant were put up in a place where the temperature is below zero, of course there would be a little more loss by conduction into the surrounding atmosphere. In London here, on some of your bright sunshiny days, you could run a plant just as effectively as in the tropics. The only reason why a sun-power plant would not be effective all over the world is that in most parts of the temperate zone there are not sufficient hours of sunlight during the year. In America our very best tests were made when there was snow on the ground, and the temperature was

below zero. The snow had just fallen, and the air was very clear.

The reason the world is colder in the winter than in the summer is not because the sun is not so hot; the sun is in reality hotter, but owing to the angle at which his rays strike the earth we get less benefit from them. For instance, in England the sun's rays strike the earth in winter at an angle as low as 35°, so that the rays are spread over a much larger surface, consequently we have much colder weather. But when you turn a surface directly towards the sun, as we do our heaters, then you get more heat in the winter than in the summer. Therein lies the difference between our heaters and the earth's surface in general; in the former case the effect is one of concentration, in the latter of diffusion.

Mr. P. J. BURGESS: If you are going to adapt your sun-power plant to places outside the tropics, it will be necessary for you to tilt your sun-catching machine, will it not?

Mr. SHUMAN: If we were to put up a sun heater here we would not turn the apparatus from north to south, but from east to west.

Mr. BURGESS: You would have to have a movement in both directions.

Mr. SHUMAN: We would prefer very much to have a movement in both directions, because we would get a better result in that case. But as the practicability of this system depends upon the yield of power per pound sterling invested, we have to throw that extra advantage away because, if we attempted to do that, our sun heater would cost so much more. If we had to turn it in both directions, it would mean such complicated mechanism that it would not be practicable.

Mr. BURGESS: Is not that a consideration which practically precludes the possibility?

Mr. SHUMAN: No, I would not propose a sun heater at the North Pole, or in unreasonable places, but I was speaking just now of Indian conditions in winter. That was the question which brought up this discussion. The sun in winter in the tropics is by no means so low as in India. I do not know exactly the latitude of that portion of India which was referred to just now, but I imagine the sun would still be at a fairly steep angle in winter, and that would make the use of a sun heater quite practicable.

Mr. BURGESS: One more question. As I understand, this sun-power plant catches the heat of the sun, turns it on to the water, turns the water into steam, and the steam is made use of in the usual way. Is there no way of turning this sun heat directly into electricity? Steam is becoming rather an antiquated form of power now. Could we not turn the heat directly into electricity?

Mr. SHUMAN: Of course, that is what is always desired. I believe every steam engineer, if he could, would go in for electricity. But turning heat into electricity is a costly thing, and it does not pay. We have done it by putting up a plant with little thermopiles, which turned the sun's heat directly into electricity, and every heater might be so constructed. But when we attempt to do that every square foot of surface costs about £10 sterling, which is, of course, out of the question altogether. We have to keep down to a matter of 2s. or 3s. per square foot.

Mr. A. S. E. ACKERMANN: Mr. Chairman and Gentlemen—I have been greatly pleased to be associated, in conjunction with my colleague, Mr. C. T. Walrond, with the interesting work of Mr. Shuman and his enterprising clients, the Sun Power Company, the directors of which are to be congratulated for the plucky manner in which they have spent large sums of their own money in the experiments. When I first heard in June, 1910, of water being boiled by the unconcentrated radiation of the sun I was very incredulous, but on arriving in Tacony, a suburb of Philadelphia, I found that the small sun heat absorber (consisting of a lamellar boiler in a flat box with a cover formed of two sheets of glass with a 1-in. air space between them) was, in fact, boiling water without any concentration by mirrors or lenses or any other means. The maximum temperature which I registered under the second layer of glass was 250° F.

There were practically no mechanical difficulties in connection with the utilization of solar energy; it was merely a question of either reducing the cost of construction of the plant, or of increasing its output per square foot of radiation collected. The improvement effected by the design of the Egyptian plant compared with that at Tacony was that the former gave 33 per cent. more steam than did the latter. Part of this was no doubt due to the improved climatic conditions in Egypt, but it was equally certain that part was due to the improved design, for on comparing the atmospheric conditions which obtained during the Tacony trials with those which obtained during the Egyptian trials, the difference was found to be small.

Another important improvement in connection with the Egyptian plant was that the output of steam was much more nearly constant than that of the Tacony plant, and was more constant than was expected. This was due to the fact that the number of solar rays caught in the morning and evening was the same as that caught at mid-day, the only difference being that in the morning and evening the radiation passed through a thicker layer of atmosphere. For irrigation purposes,

however, it mattered little that the output of steam was about 17 per cent. greater at mid-day than in the morning and evening.

The maximum thermal efficiency of the Egyptian sun-heated boiler was 40·7 per cent., which compared very favourably with the thermal efficiency of an ordinary steam boiler of about 70 per cent., when the relative state of development of the two types of boilers was taken into account.

During the discussion of a paper on "The Utilization of Solar Energy," which I read before The Society of Engineers (Incorporated) last April, a speaker pointed out that glass mirrors cause a loss on account of the absorption of the radiant energy by the glass of the mirrors. This is true, and possibly the loss may amount to 15 per cent., but it is important to remember that when solar radiation had been passed through one sheet of glass, the rays which emerge are more capable of passing through a second sheet of glass. In other words, practically all those which could not pass through glass were stopped by the first sheet, so that when the radiation was reflected from the silvered surface of the glass back through the latter, a second 15 per cent. was *not* lost. Metal reflectors would much reduce the loss by absorption compared with the silvered glass reflectors and would no doubt be more efficient, but unfortunately no practical metal reflector could be used which would have a sufficiently hard and untarnishable surface. If the surface were not hard it would get scratched by repeated removal of dust, and if it were not untarnishable it would also lose its efficiency.

The President: Mr. Chairman and Gentlemen—I am afraid I can only make a small contribution to the discussion. I have followed the results of this scheme of Mr. Shuman's with much interest, and a short time ago I went to Meadi, in Egypt, in order to see the plant at work. I regret, however, to say that on this occasion the sun had not been seen for a week, and the Nile had fallen far below the intake for the water. I was therefore obliged to come away without seeing the plant in operation. At the same time, I feel that the attempts Mr. Shuman is making are not only most interesting and important, but are certainly attempts which ought to be systematically continued, because it looks, especially from what Mr. Ackermann has just told us of the thermal efficiency, that provided all mechanical difficulties can be got over, we shall be in possession of a source of power for the tropics which will be extremely efficient and extremely economical. I hope that before the Congress meets again we shall have a further report showing that success has been met with in more than one place. One difficulty which occurs to me is that the actual amount of

space taken up by the apparatus is very large, and it would, therefore, be better to work it in countries where land is of small value. The cost of the large amount of ground which the installation covers seems to me a factor which will have to be taken into account.

The CHAIRMAN: Gentlemen—The hour is getting late, and I will now terminate these proceedings by expressing to Mr. Shuman our very cordial thanks for his most interesting paper.

Mr. SHUMAN: Gentlemen—I thank you very much for the attention you have given to an entirely new subject, and I know it will arouse a great deal of thought. One of the unfortunate things is that if we want to go into this question deeply, and understand everything connected with it, it would take in the first place two or three weeks' thinking over, and afterwards a couple of weeks' discussion to make everything clear in detail. We shall learn a great deal more about sun power, but we are already in a state of higher efficiency than the steam boiler was, comparatively speaking, fifty years ago; and the steam boiler had already had about 100 years of development before that. There was a time when all your coal treasures lay underground in England; nobody knew of their worth. They were not even used for burning in houses 300 years ago, and were not used for mechanical power 160 years ago. There were all those treasures lying idle, and not used at all. Now you have in the tropics a treasure a million times more precious, because it is perpetual and can never give out.

FRIDAY, JUNE 26.—MORNING SESSION,

10.30 A.M.

Agricultural Credit Banks and Co-operative Societies.

Chairman: THE RIGHT HON. SIR HORACE PLUNKETT, K.C.V.O., F.R.S., *late Vice-President, Department of Agriculture and Technical Instruction for Ireland.*

THE CHAIRMAN: Professor Dunstan and Gentlemen—We are to deal to-day with a subject to which perhaps I may attach undue importance, but as we have to deal with it in an hour, that renders it impossible for me to do justice to the subject without doing grievous injustice to those who have prepared papers, and to those who wish to hear them. I recognize that there is one limitation upon our discussions. We are not here to treat of general principles, but rather of their particular application to certain countries, so that I shall devote the very few remarks I shall make to what you may possibly find of suggestive value in the co-operative movement generally in these islands.

As we all know, the co-operative movement began in England in the "hungry forties," and has extended since all over the world in its various forms. The first thing that I have to say about the co-operative movement in England is that it hardly touched agriculture at all until the beginning of the present century. In Ireland, on the other hand, just a quarter of a century ago, the agricultural co-operative movement was founded to deal with the special circumstances of that country, and there are, I think, a few points in that movement which are worthy of consideration from those who come from tropical countries. Ireland, of course, is a country where, meteorologically speaking, the temperature is low, and I realize that I must remember the warning given to us by the President of the Congress in his opening Address,

that no knowledge of general principles will avail without a knowledge of the conditions of tropical countries. But in Ireland we had to supplement an agrarian revolution, which was about to transfer, and has now about half transferred, the agricultural land of the country from a small class of landlords, largely regarded as aliens, to a numerous class of cultivators, mostly peasant proprietors. The State, by the advance of some £200,000,000 sterling, and large sums given as a free grant, are carrying out this huge transaction, but they are doing nothing, and could do nothing, or could not do much, to make the necessary changes in the social economy of the agricultural classes which would be required in order to enable the new owners of land to prosper, and to fulfil their huge obligation to the State. We laid down, after years of thought and experiment upon the question of a satisfactory rural economy, two main propositions. The first is that if you want to solve the modern problem of rural life—that is the problem of inducing and enabling people to maintain a decent standard of comfort in a rural existence in these days of world-wide competition—you have to approach the problem from three points of view. You have to look upon agriculture as an industry, as a business, and what is perhaps more important than all, as a life. You have to bring into industry the teachings of modern science, into business the methods of our modern business, and into life a scheme of social attraction and amenities; certain intellectual advantages which will enable rural life to resist the lure of the city. The first proposition is, then, that you have to deal with the problem on its three sides; and the second, that you must deal with the business of farming, and the chief reform you have to make there is to introduce methods of combination. We live in days when everything has to be done in a large way—to be done to pay—and when the small producer is at the mercy of powerful middle interests, trusts, combines, and so forth; so that the first thing is to get a sound economic basis by teaching the farmers to combine, and the only method of combination which is suitable to farmers, as we all know, is not the joint-stock method, but the co-operative movement. I have always felt that the reason that agricultural co-operation lags so far behind—the reason why even in this Congress it is not thought necessary to give more than an hour or so out of a week to the discussion of agricultural co-operation—is that in

the urbanization of all thought people in these days think the town method is suitable to the country conditions. They are still hankering after the joint-stock method, and have not yet learnt that co-operation is the only method suitable to agricultural conditions. Therefore, we say you have to start by teaching co-operation, and that until you have done that you cannot successfully introduce scientific methods into the practice of agriculture, nor until you have got people to come together in the business of their lives can you get them to come together for higher intellectual and social purposes.

Our formula in Ireland for solving the rural problem has some notoriety now. It is better farming, better business, better living, and we say that you must begin with better business, and that better business is co-operation. Now I say nothing about the Eastern origin of the most typical of the Irish people. I think myself that their addiction to co-operation has a great deal to do with that. But, broadly speaking, the Irish belong to the associative races rather than to the individualistic, and that is a tremendous advantage, and it is in that respect that I think many of the tropical countries, especially India, might learn a great deal from our work in Ireland, not so much perhaps from the successes as from the failures. I myself have had five-and-twenty years of work in that country, and I have learnt far more from my failures than I have from my successes; and I am in a position now, in dealing with people who have the same kind of outlook towards this problem, to suggest to them how to avoid many of the mistakes we have made.

The most important respect of all, I should say, in which co-operation in dealing with the tropics has to be studied is in the precise relations which ought to exist between State assistance and organized voluntary effort. As you go down in the economic and social scale it becomes more and more necessary to develop self-reliance, but at the same time it is more and more necessary to begin with State assistance. And the whole problem, it seems to me, in countries like India, where the co-operative movement is in the hands of what I think is the finest Civil Service in the world, is how to administer large doses of State assistance without weakening the patient's resistance to the many diseases which attack the principle of self-help.

I have one practical suggestion to offer, and that is, that this Congress should recognize that agricultural organization

is not an amateur business, but a very highly technical business, and that men must be trained for it if they are going to have any success at it. That we have learnt in Ireland; they have learnt it in England, and they have learnt it in Scotland. We have had in these countries, where the whole trend of thought had gone against co-operative action, to found agricultural organization societies simply and solely for the purpose of teaching people who do not understand co-operation how to organize co-operative associations for every agricultural purpose; and I happen to know that they are coming to this view in the United States and in Canada, and that schemes are on foot for training organizers to start co-operative movements in these countries. I believe that at the Tropical Agricultural College which is about to be founded somewhere in the Empire, in order that teachers qualified to teach scientific principles of agriculture should be able to learn how to apply those principles to tropical conditions, it is highly important that agricultural co-operation should be taught in this College, and that the agricultural organizer, even if he has learnt his business, as he can learn it in these islands, should go there and learn how to organize in the wholly different conditions of the tropical countries.

The following paper was then read:—

AGRICULTURAL CREDIT BANKS AND CO-OPERATIVE SOCIETIES.

By Sir James Douie, K.C.S.I.,
Late Financial Commissioner in the Punjab.

[Abstract.]

1. Individualism, socialism, and co-operation. The last the true remedy for the evils caused by an exaggerated individualism. Co-operation the outcome of strong necessity. While well fitted to increase the profits of prosperous people, it has at the outset found its home among struggling people.

2. The birth of the co-operative movement in Europe between 1840 and 1850. The English movement started with co-operation in distribution for the benefit of artisans, the German movement with co-operative credit.

3. Schulze-Delitzsch and Raiffeisen Banks in Germany. The latter the more important in connection with the development

of agricultural credit in tropical countries. Changes of type as the movement has progressed in Germany. Development in Germany.

4. The Casse Rurali of Italy. Experience derived from the countries which once formed part of Turkey in Europe, of special interest in connection with the prospects of success in eastern and tropical countries. Servia, Bulgaria, Rumania, Cyprus.

5. Lessons to be gathered from successes and failures in European countries as to:

(*a*) The features which are essential in agricultural or rural credit societies.

(*b*) The functions of the state in connection with them.

6. The problem which presents itself in eastern and tropical countries not identical with the European problem because of:

(*a*) The different character of the people at the present stage of their development, and

(*b*) The comparative absence of ordinary banking facilities.

7. Hence experience to be gathered from the Indian Empire, a large part of which lies within the tropics, while the rural population as a whole is less advanced than that of most European countries, should be of special use to a Congress of Tropical Agriculture. Further, it must be remembered that in some of our tropical Crown Colonies East Indians are now an important element in the population, and form a good field for the organization of co-operative credit. Reasons why author will devote special attention to the Punjab.

8. The Indian population predominantly rural, being engaged either in the tillage of the soil or in handicrafts ancillary to tillage. The population of an ordinary Punjab village. Distribution of land and general nature of agriculture.

9. Effect on landholding and cultivation of the establishment of British rule.

10. Gradual rise of problem of agricultural Indebtedness. Its serious character.

11. Agricultural State Loans to peasant farmers. Successful working for sixty years. Analogy of Turkey.

12. Restrictions on the peasant farmer's title to alienate his land. Analogy of Servia.

13. Rise of co-operative credit societies. Indian societies predominantly agricultural, and attention will be confined to societies of that class.

14. Indian legislation. Acts of 1904 and 1912.

15. Types of agricultural societies.

16. Unions and central banks. Ordinary joint-stock banks as a source from which money can be borrowed for rural societies.

17. The functions of the State in connection with Indian credit societies.

18. British Colonies and Dependencies broadly divisible into countries in which people of European descent can do field work efficiently, and countries in which farm labour must be done by indigenous or imported coloured people. Tropical countries and a considerable area north and south of the tropics fall into the latter category. The difference is reflected in the form of administration. In the one class we have the self-governing Colonies, in the other the Crown Colonies, and our great Indian dependency, where "popular" government is impossible.

19. So far as agricultural credit banks are concerned attention may at present be confined to the coloured population indigenous or imported.

20. While co-operative credit in Europe is not confined to *small* farmers, it is not likely to be adopted under present circumstances to any large extent by farmers of European descent in our Colonies or European landowners in the West Indies. Apart from the ordinary credit to be got from joint-stock banks, they will rely on agricultural State loans granted at moderate rates of interest and secured by mortgage of real property. Such loans should bear such a rate of interest as to make it perfectly certain that they are not being made at the expense of one class in the community for the benefit of another class. Dangers surrounding the system in democratically governed countries. Agricultural loans in the West Indies, Australia, New Zealand, Rhodesia, South Africa.

21. The indigenous coloured populations and the imported labourers—Ceylon, West Indies, Fiji, Africa.

22. Rural credit societies in Ceylon.

23. Land settlement in West Indies. Land-holding by East Indians in Africa and Fiji.

24. Land settlement should be supplemented by the organization of agricultural credit societies. Discussion of the question in the West Indies.

25. Case of St. Vincent. Action taken and result.

26. Case of British Guiana. Action taken.

27. Scope for further action.

28. Organization of societies should conform mainly to the Raiffeisen type. The people have to be trained to—

(*a*) Exclude unworthy members.

(*b*) Save and deposit savings.

(*c*) Make only safe loans.

(*d*) Spend loans honestly on objects stated.

(*e*) Pay punctually.

(*f*) Postpone individual profit to the necessity of building up a reserve.

29. Action that may profitably be taken by the State under the three heads—

(*a*) Education.

(*b*) Inspection, control, and audit.

(*c*) Lending money.

Where it prescribes accounts or demands returns these should be extremely simple.

The following papers were taken as read:—

AGRICULTURAL CREDIT IN THE PORTUGUESE COLONIES.

By Henrique José Monteiro de Mendonça,
Vice-Governor of the Overseas National Bank,

José Dionisio C. de Sousa e Faro,
Late Governor of Zambezia,

and

Ernesto Jardim de Vilhena,
Late Governor of Lourenço Marques.

[Abstract.]

This statement has been prepared under the auspices of the special Portuguese Commission appointed to superintend the preparation of reports and papers for the Third International Congress of Tropical Agriculture. It describes the operations of three of the chief concerns which have been organized in Portugal to facilitate the agricultural development of the Portuguese Colonies, viz., the Banco Nacional Ultramarino, the Companhia de Moçambique, and the Companhia de Zambezia. The Banco Nacional Ultramarino was founded in May, 1864, and, as its name implies, its operations are concerned entirely with the overseas possessions of Portugal. It makes advances, repayable by annual instalments, to promote irrigation works, the construction of roads, the formation of plantations, and other similar operations necessary to agricultural development, and in addition offers all the usual banking facilities to planters and planting companies. Its statutes defining agricultural credit and stating the conditions under which advances are made are quoted in some detail in the paper, and instances are given of the assistance it has rendered in the development of Angola, St. Thomé, Principe and the Cape Verde Islands.

A short account of the facilities offered by the Companhia

de Moçambique to settlers in its territory is also given: these include a labour bureau, a system of hiring out agricultural machinery, assistance in boundary surveys, provision of packing materials for agricultural produce, the purchase of farm stock by instalments, and assistance in the sale of produce in Europe.

Similarly the Companhia de Zambezia, with a view to developing tobacco cultivation in its territories, has instituted a scheme whereby settlers are provided with land, draught cattle, machines, drying stores, food and pay for native labourers, on condition that they grow tobacco on the land and pay interest at the rate of 7 per cent. per annum on the sum expended by the Company for their benefit. The Company buys all the saleable tobacco produced, at the rates current for tobacco in Nyasaland, and is prepared to take back the farm animals and machinery, less depreciation at the rate of 20 per cent. on the initial outlay, when the contract expires.

THE WORKING OF CREDIT BANKS IN THE NETHERLAND EAST INDIES.

By H. Carpentier Alting, Batavia.

[No abstract supplied by the author.]

[Discussion.]

Sir James Wilson: Mr. Chairman and Gentlemen—Sir James Douie and I have had a similar experience in India, and I think I agree with him upon most important points, although there are some little details over which we might argue very hotly. But on this question of agricultural credit I agree with almost every word he has said. He has given you a very masterly exposition of the state of things in India, and his advice, I think, is very wise. I should like to emphasize one or two points. One is about the extent of State control which is required in tropical countries. Of course, things differ very much as between European countries, with intelligent populations and a large body of trustworthy educated men, and countries like India and most tropical countries, where there is a very small proportion of the population who are sufficiently educated and trustworthy to conduct a movement of this kind apart from State assistance. In backward countries it is extremely necessary that the State should control such a movement for many years, at all events, after its inception. After all, credit and other forms of co-operation also depend upon confidence. Confidence can only be acquired by providing the

people whose co-operation one wishes to secure with an efficient and trustworthy body of inspectors and advisers. In India we have done so by appointing official registrars in different provinces, under whom there work inspectors trained by them, and although in India—very properly I think—we are trying by degrees to hand over the duties of inspection and audit to unions of the various societies themselves, there must always be—at least I hope there will always be—Government authority over them that will give every little society the feeling that the inspection and audit is practically a thing for which Government continues to make itself responsible.

Now as regards tropical countries such as our own Colonies, and those of other European powers, where it is desired to encourage co-operation among the people, I make one suggestion which I think has already been adopted by Mauritius. As I said, the problem differs very much as between European and tropical countries. Formerly, when we started the system in India, we had to come to European countries to learn what co-operation meant. In India we have now had about ten years' experience of our own, and we have a considerable number of European officials who have studied the question very carefully, and have got a great deal of experience in starting and working the 12,000 societies now in existence. Mauritius is following our example, and has asked the Indian Government to send a man to try to start the same system, especially among the Indian population of Mauritius. I venture to advise any tropical country which thinks of starting such a system either to ask the Government of India to send them a man, or themselves to send a colonial man to India so that he may wander about there seeing how difficulties have been met and overcome so successfully in India. I need not add anything about the great importance and advantage of the encouragement of co-operation, especially among small peasants. I myself like to dwell not so much upon the economic advantages as upon the great educational advantages of co-operation. It brings the people together, it helps them to help each other, and it discourages petty jealousies. It makes a great difference to them intellectually and morally as well, and it is of very great importance not only to the economic welfare of the people, but of still greater importance to their moral and intellectual welfare.

Mr. Henry W. Wolff: Mr. Chairman and Gentlemen—I thoroughly endorse what Sir James Wilson has just told you, but I would add that it was on my advice that Mauritius sent to the Indian Government for a registrar to teach the natives. If any other tropical countries intend to introduce

co-operation, more particularly co-operative credit, in which India has made a success quite unique in the history of co-operation, I think they will do well to send there, and ask for tuition.

I want to point out particularly in connection with the paper by Senhor Mendonça and his colleagues, that the pioneers of co-operation in Portugal have distinctly preferred co-operative credit, and that all other methods have failed. You see the results of the opposite policy in France and in Italy, where Government help given without the aid of co-operative societies has wholly broken down. In Egypt they began with the National Bank lending money. That system has been unsuccessful, because the people would not repay what they thought was a gift, and they contracted the bad habit of running into debt. A few years ago there was about £40,000 overdue. They could not proceed against them, and they had to pass the five feddan law, which makes properties under five feddans inalienable. With that the general system of agricultural credit ended. Now they are turning their minds to co-operative credit.

Sir James Wilson has very rightly emphasized that in tropical countries you cannot apply the same standard that you do in European countries, where people have some idea of business and some degree of self-confidence and self-reliance. You have to begin there with what may be called an infant school training for co-operation. In some countries you will be worse off even than in India, because in India after all there is money. You will have to find some source of supply which will give you the money, and which will fit the people gradually for practising co-operation. Therefore in countries of that description I am not at all opposed, as I have sometimes been reproached for being, to State assistance if applied on the right lines. If, as I believe is necessary, State aid is to be given for training up to co-operation, I think three conditions must be observed. In the first place you must not supply more from outside than is strictly necessary. That is the principle they have adopted in India, and Lord Curzon has done me the honour of referring to me as the authority in deference to which he has adopted it. He said: "We are not niggardly; we do not grudge the money, but we do not want to spoil co-operation." You must supply only what is necessary, and by that means train the people gradually to calculate, and to deal in a business-like way with their money. The second point is that you should give help on business lines. In India the Government lent money at 4 per cent., which was under the usual rate, and the registrar at once protested that that

upset the scheme, because he wanted to train people to business habits, to calculate what the money was worth and would bring them, and getting money for nothing, or for lower than the market rate, spoiled that effect. The third thing is that you must use State aid simply as a means of teaching people self-help and self-reliance. That is what the Indian registrars have done to a wonderful extent. They are State servants, but they are outside the political service, and they try to keep the political business of the Government out of the matter as much as possible. They impress upon the people who are forming the banks: "You must learn to manage things yourselves, to practise self-reliance and self-help." If those three points are kept in view, I think co-operative credit, which I hope will develop into co-operation in agriculture generally, may render considerable service in tropical countries. I do not know the tropical countries myself, but I have had correspondence with authorities in various parts of the globe, and from what they have written to me I have very great confidence that co-operative credit, which has proved such a source of education, of health and well-being in Europe and in India, will also have the same effects elsewhere under the tropical sun.

Mr. J. Peiris (Low-Country Products Association, Ceylon): Mr. Chairman and Gentlemen—In the absence of Mr. Lyne, the Director of Agriculture in Ceylon, who has shown much interest in this movement for co-operative societies in the island, and who would have been able to speak with authority on the subject, I have been asked to say a few words regarding our experience in connection with co-operative credit societies, and drawing attention to some of the difficulties we have met with.

You must remember that in Ceylon, and in India generally, agriculture was co-operative. That is to say, agriculture was carried on in the village by the villagers under a system of co-operation. But there was no money passing in those days, or not much at any rate. The people who co-operated in agriculture got their share in the produce. Well, that system worked very well indeed, but with the introduction of Western ideas it was broken up, and in place of it the system of dealing in money arose, and this has led to a number of difficulties. Mainly the difficulty has been that gradually the people, having to rely on their own resources for cultivation, and sometimes meeting with bad years, have fallen into debt, and got into the hands of usurers. So the problem they had to face was that they had to pay a very high interest on their loans, and gradually their lands passed into the hands of usurers. Well, I think

this co-operative credit movement has come as a great boon to these people, and something has been done of late years in our island with regard to this. An Ordinance has been passed on the lines of that of India, and we have followed very much the Indian methods. State aid is given under certain circumstances. That question, as in all other countries, has proved to be a very difficult one, and that is one of the points on which I have had much enlightenment from the paper read by Sir James Douie, and from the remarks of subsequent speakers. Lately a Committee has been appointed by the Government to go into this question of the conditions under which State aid should be given to cultivators, and that is really the most important question which touches this matter in our island. You must remember that the people are very poor, and they cannot contribute very much, but all the same it is very necessary that such State aid as is given should be controlled, and given under strict conditions. If that is done, and if the people are taught gradually to put in their own money, and to work on a co-operative basis, I am sure there is a great future for our peasantry. As was pointed out by a previous speaker, what is wanted is not the joint-stock method, but the co-operative method. But the latter is a method which cannot be introduced at once—people have to be educated into it—and I am glad to see that Sir James Douie in his paper drew attention to the necessity for education, and to the work that civil servants and others could do in furthering the co-operative movement, and in educating the people to utilize it to its greatest extent. I must say that our Director of Agriculture has done a great deal to educate the people in this way. A secretary has been appointed, who assists the villagers in starting agricultural societies, and this secretary goes round to all the villages and lectures on co-operation. In this way much has been done, and I have no doubt that with the assistance and sympathy of the civil service and members of the agricultural department we shall be able to extend the co-operative system to the general benefit of the peasantry of Ceylon.

Professor P. Carmody (Director of Agriculture, Trinidad): Mr. Chairman and Gentlemen—Co-operative credit is at the present moment one of the questions coming into considerable prominence in Trinidad. The example has been set us by St. Vincent, where they have already started co-operative banks, and we intend to follow somewhat on the same lines. I might mention that one of the greatest obstacles to success in the co-operative movement among the people we have to deal with is the making of a false step. One has to proceed very

carefully before one can hope to succeed. Unfortunately for us, we did make a false step about twenty-five years ago, and we have not recovered from that. We started with a People's Bank, which was in existence, or about to come into existence, at about the time I went to Trinidad; and the people's idea of a People's Bank was something like this: it must be a huge building from which huge sums of money could be drawn without any need for repayment. I need not tell you, Sir, that that bank did not run long.

Now we have some advantages in the West Indies, although we have many disadvantages. One advantage is that the people are very fond of their land. They have the land hunger as in other parts of the world, and the small proprietor likes to be a small proprietor. We have people of different nationalities, but we have 100,000 East Indians among a population of over 300,000 people, and in this class we have a thrifty population extremely eager to become possessed of land, and who, as a general rule, become good cultivators, learning Western methods, which they have not been able to learn in their own country. Although they are first of all trained on sugar estates they become very good cocoa cultivators after a time, and even before the period of their indenture expires they save up enough money to buy land, and in some cases begin to plant cocoa before they are free. Now one of the difficulties—the most serious difficulty—we have in Trinidad is that we have a great difficulty in getting people to pay back what they borrow. My chief hope lies in the following direction, and I have been aiming at it for some years—to educate the small man into the realization of what Sir Horace Plunkett referred to in his opening remarks—that agriculture is a pure business. Some have not the slightest idea of what it costs them to cultivate, say, an acre of land, or how much it gives them back in return—absolutely no idea; and they have usually to obtain credit for their ordinary domestic supplies, and to pay for it at enormously high rates. If they borrow money, the rates of interest they pay may be anything from 40 to 100 per cent. My hope is that the system of education which we have adopted among the peasant proprietors for the last few years will develop a better class among the cultivators. We have adopted a scheme of prize giving to small proprietors in cocoa cultivation, which we shall extend in other directions later on. They are men who are being educated to understand that they must get a return, or ought to get a certain return, for the expenditure of whatever labour or capital may be required on their small holdings. They have a great desire to hold on to their small holdings,

they have a desire to improve their cultivation, and it is among these people that I hope to see the agricultural co-operative banks succeed.

The CHAIRMAN: I am afraid the time is approaching when the next subject on the programme will have to be taken. With the consent of the President of the Congress I am to submit for your consideration a resolution. I think that those who have listened to the too few speeches which have just been delivered will have come to the unanimous conclusion that co-operation in the tropics is a very real and live issue. As you know, in the United Kingdom agricultural co-operation has become a matter of public interest quite recently, and we who are watching the movement find that in every civilized country in the world which had not formerly adopted agricultural co-operation, it is being enthusiastically taken up. Well, it would be a pity if this Congress were to separate without having taken some step to see that the subject is not derelict. I mean that if you do not treat it at all it will not only be a great loss to the movement, but it would positively do harm, because naturally all outsiders like myself would come to the conclusion that agricultural co-operation is not practicable in the circumstances of the countries from which you severally come.

The resolution that I would submit is:—

That a Committee be appointed by this Congress with instructions to see that the subject of agricultural co-operation (including credit) is given a prominent place at the next Congress, and to obtain reports from every tropical country where the subject is being considered and is the basis of action by Governmental authorities, or voluntary agencies.

I suggest that resolution just to keep the question alive, and to ensure that it has a prominent place at the next Congress, when no doubt it will have a very much more important place in the life of tropical countries than it has at present.

The PRESIDENT: I have very much pleasure in formally seconding the motion which Sir Horace Plunkett has made, and in promising that if you adopt it it shall be brought before the General Assembly of the Congress next Tuesday. I ought perhaps to apologize to Sir Horace Plunkett for the fact that such a very short time can be given to this very important subject, but as those concerned in the arrangements made for this Congress are aware, our difficulty has been to fit in the number of different subjects which have had to be discussed, within a week. It has really been a very serious difficulty, and it has led to some subjects having been omitted altogether by force of circumstances, and to other subjects not perhaps

receiving the amount of time and attention which is due to them. But the appointment of a Committee to consider an important subject of this kind in all tropical countries is really the best and most effective method, I think, of dealing with this matter. I have very great pleasure in seconding the resolution which Sir Horace Plunkett has proposed, and it is for you to say whether it shall be adopted by this meeting or not.

The resolution was put to the Congress, and carried unanimously.

On the motion of the President a vote of thanks was accorded unanimously to Sir Horace Plunkett for presiding.

FRIDAY, JUNE 26.—MORNING SESSION,

11.45 A.M.

The Organization of Agricultural Departments in Relation to Research.

Chairman: THE PRESIDENT.

THE PRESIDENT: Gentlemen—We are already somewhat late in beginning this discussion, owing to the time taken up by the preceding one, which happens to have been of exceptional interest. I think, perhaps, the best way to open the subject, at any rate from my point of view, will be for me to read to you a portion of my Presidential address relating to this particular topic which I was obliged the other morning to omit. I may point out that the main topic for consideration is the organization of Agricultural Departments in Relation to Research—that is to say, the organization of agricultural departments in such a way as to secure the systematic and continuous investigation of general problems of scientific importance. One is obliged to admit that in a large number of cases where agricultural departments are doing excellent work, there is not, for several reasons, the possibility of carrying on continuous research. Now that, of course, is a very great detriment to the advancement of the subject, and it is a point I feel sure those of us who are interested in the scientific advancement of agriculture ought to attend to. I wish it to be clearly understood that I should be the last person in the world to put this forward as a complaint against Agricultural Departments in the tropics, because I know the difficulty arises partly from want of staff, and chiefly from want of funds assigned by Government for this particular work. I will read a very short portion of my address, which deals with the subject. I think it may serve as an introduction to the discussion which is to take place.

The President then read an extract from his address (see pp. 52-56), after which the following papers were taken:—

THE ORGANIZATION OF AGRICULTURAL DEPARTMENTS IN RELATION TO RESEARCH WORK.

By BERNARD COVENTRY, C.I.E.,[1]

Agricultural Adviser to the Government of India and Director of the Agricultural Research Institute, Pusa, India.

[ABSTRACT.]

The guiding principle in the organization of an Agricultural Department for the conduct of research should be to grant to each branch of science represented the fullest scope of freedom compatible with due recognition of (1) the governing authority; (2) the limitation of its own sphere of work; and (3) the possibilities of a carefully prepared budget. The success or failure of a department organized on these lines will depend primarily on the capacity of the scientific officer in each branch of investigation, and such officers should be engaged on probation for a term of three years, and their appointments should not be confirmed at the end of the probationary period unless they have proved themselves suitable. Once their appointments have been confirmed, initiative in their branch of work should be left very largely to them. Collaboration between officers engaged in different lines of work should be a matter of private arrangement between them, so long as the assistance to be afforded by one of them is ancillary only. More complete collaboration should be arranged for by a council composed of the chief officers in each branch of science represented in the department.

An Agricultural Department organized for research should possess a Central Research Institute with modern laboratories and an experimental farm. The work should be divided into the following branches: Agricultural, chemical, botanical, bacteriological, pathological, entomological, and veterinary, each with a chief scientific officer having the highest qualifications. In addition there should be a division to take charge of the library and publications of the Institute, and finally an additional officer for each special crop, such as cotton, sugar cane, rubber, etc. The Director of such an Institute should be selected on the grounds of capacity for organization and control, coupled with sympathetic insight and understanding of the work to be done.

In addition to this Central Research Institute there should be a series of local organizations each with its own administrative

[1] This paper was read for the author by Dr. C. A. Barber, Delegate of the Government of India.

head, to demonstrate locally the results of research, to distribute seed of improved varieties of crops, and to carry on experiments in their own localities. The constitution of these local organizations must depend to some extent on local conditions, but it should always have an agricultural, rather than a scientific basis.

THE ORGANIZATION OF AGRICULTURAL DEPARTMENTS IN RELATION TO RESEARCH WORK.

By Gerald C. Dudgeon, F.E.S.,[1]
Consulting Agriculturist, Ministry of Agriculture, Egypt.

[Abstract.]

The importance of combining scientific with practical methods for the improvement of agriculture is evident, and the share of such work which a Government Department must take up is that of conducting the scientific research work upon the basis of which advice and assistance can be accorded to the nation.

A definition is given showing the difference between demonstration and experiment farms, both of which are necessary in connection with research work; the former demonstrating results and being conducted with a view to the greatest possible monetary return, and the latter constituting the steps towards the attainment of results, without any profit being contemplated.

Details of the principal staff required for a scientific section of an Agricultural Department, together with their duties, based upon what has been found necessary in Egypt, are given, as well as references to some indispensable adjuncts in connection with research work.

ORGANIZATION OF RESEARCH WORK FOR TROPICAL AGRICULTURE.

By Dr. C. J. J. van Hall,
Chief of the Division for Plant Diseases, Department of Agriculture, Java.

[Abstract.]

Several branches of science are at the present time indispensable to agriculture. The most important are: Phytopathology and economic zoology, plant-breeding,

[1] This paper was read for the author by Dr. L. H. Gough, Chief, Entomological Section, Ministry of Agriculture, Egypt.

acclimatization of plants, agronomy, agricultural chemistry, agricultural geology, and agricultural bacteriology.

In each of these branches two spheres of action are to be distinguished: (1) The scientific investigation of the problem, and (2) the practical application of the results. The one may be described as the task of the man in the laboratory and the experiment garden; the other as the task of the man in the field. Both are equally scientific and equally important.

The organizer of an agricultural institute has to take care that opportunity is afforded for the development of both these spheres of action.

Though both tasks are of equal importance, the manner of working of the two scientists is different. The worker in the laboratory has to investigate the problem as deeply as he can, without hurrying to obtain practical results, while the worker in the field has to go straight to the object in view.

While thus a division of labour has to be observed, it is not less important to obtain collaboration in each branch between the worker in the laboratory and the worker in the field, as between the different branches of science.

ORGANIZZAZIONE DEI SERVIZI AGRARI IN TRIPOLITANIA.

Per Professore Emanuelle De Cillis,[1]
Direttore dell'Ufficio Agrario.

[Abstract.]

Sulle traccie degli studi e delle proposte delle Commissioni agrologiche inviate dal Governo e dalla Società Italiana per lo Studio della Libia in Tripolitania, è stato istituito a Tripoli un *Ufficio Agrario* dal quale dipenderanno tutti i servizi inerenti alla agricoltura e alla colonizzazione. Essi saranno organizzati in due Sezioni: —

1°. *Sezione amministrativa.* Comprenderà: —

(*a*) Un servizio permanente di ricerche onde accertare e seguire metodicamente il movimento economico-agrario della regione. Esso verrà svolto mediante: la formazione di un catasto agrario per mezzo del censimento dei poderi, delle piantagioni e del bestiame; rapporti periodici sull'andamento dei raccolti, sulle faccende agrarie ed altri fenomeni economici; inchieste speciali eseguite nelle varie plaghe e sopra determinati argomenti.

[1] This paper was read for the author by Dr. O. Manetti, Vice-direttore dell'Istituto Agricolo Coloniale Italiano.

(*b*) Un servizio della colonizzazione: per mezzo di ricerche dirette sulla disponibilità e qualità dei terreni colonizzabili; guide e monografie illustranti determinate plaghe e tipi di coltura; carteggio informativo diretto fra l'Ufficio e gli agricoltori di Italia o altri Enti; consulenza ed altri aiuti morali diversi.

(*c*) Un servizio del genio rurale; cioè studi ed esecuzione di opere pubbliche, specialmente di indole idraulica, dirette ad utilizzare le risorse naturali del paese e mettere alcune plaghe adatte in condizioni di essere utilmente colonizzate.

(*d*) Un servizio diretto a favorire l'incremento dell'agricoltura indigena e coloniale, mediante pubblicazioni, sussidi e premi; distribuzioni di semi e piante; prove pubbliche di macchine e delle principali pratiche di coltivazione; impianto di monta; stazioni di profilassi e cura delle malattie delle piante e degli animali.

(*e*) Un servizio sperimentale delle concessioni che si occuperà di sperimentare la concessione di terreni demaniali, applicando tipi contrattuali diversi sopra a poderi diversi per estensione, per sistema di coltura e per amministrazione.

2°. *La Sezione tecnica* comprenderà: —

(*a*) La sperimentazione della tecnica colturale più adatta alle coltivazioni erbacee ed arboree, asciutte ed irrigue e degli allevamenti, nei riguardi del sistema pastorale, di quello forestale (specialmente frangiventi e fissazione di dune) e di quello agrario.

(*b*) Lo studio delle razze di piante coltivate in Tripolitania e di quelle esistenti in altre parti del Nord-Africa o altrove, che potrebbero utilmente introdursi.

(*c*) Lo studio economico-agrario sulla formazione di aziende irrigue od asciutte, e cioè sulla preparazione e relazione fra i diversi capitali occorrenti all'impianto ed al funzionamento.

(*d*) Il servizio meteorologico, che comprenderà un osservatorio centrale, sei osservatori regionali e 16 stazioni termoudometriche. La sezione amministrativa ha sede in Tripoli ed è in relazione diretta con gli organi amministrativi delle varie regioni. Quella tecnica ha sede fuori dell'oasi di Tripoli, nell'ex scuola di agricoltura turca ed avrà alla dipendenza, oltre la rete meteorologica di tutta la regione, anche dei campi sperimentali opportunamente disposti nelle varie plaghe.

Nel bilancio coloniale per l'esercizio 1914-15 è impostata, per lo svolgimento dell'attività dell'Ufficio Agrario, la somma di L.716 mila.

Tale somma si accrescerà negli esercizi venturi, a misura che i vari servizi andranno impiantandosi e perfezionandosi, ed aumenterà l'importanza della colonizzazione italiana in Tripolitania.

[TRANSLATION.]

ORGANIZATION OF AGRICULTURAL SERVICES IN TRIPOLI.

As a consequence of the studies and proposals of the Agricultural Committees sent out by the Government, and by the Italian Society for the study of Libya in Tripoli, there has been instituted in Tripoli an *Agricultural Department* to which will be subordinated all the services referring to agriculture and colonization. These services will be organized in two sections:—

(1) *Administrative Section.* This will include:—

(*a*) A permanent research service for ascertaining and following up, in a methodical manner, the economic agrarian movement of the district. It will be developed by the following means: The formation of an Agrarian Register from a census of the properties, plantations, and cattle; periodical reports on the progress of crops, on agrarian matters and other economic factors; special inquiries, carried out in the various districts on definite lines.

(*b*) A service of colonization. This will include direct investigation with respect to the availability and quality of lands capable of colonization; guides and monographs illustrating definite districts and kinds of crops; direct information by correspondence between the Department and agriculturists, or others, in Italy; advice and other like assistance.

(*c*) A service of rural engineering; that is to say, the study and initiation of public works, especially those in connection with irrigation, intended to render available the natural resources of the country, and to make the colonization of certain districts possible.

(*d*) A direct service for encouraging the development of native and colonial agriculture, by means of publications, subsidies, and premiums; distribution of seed and plants; public tests of machinery and of the principal modes of cultivation; establishment of stud farms and of preventive and curative stations for dealing with diseases of plants and animals.

(*e*) An experimental service of concessions, which will carry out experiments in connection with the granting of concessions of domanial lands, by applying types of contracts to the different properties, which will vary with respect to extent, system of cultivation and administration.

(2) The *Technical Section* will include:—

(*a*) Experiments as to the most suitable technical methods for the cultivation of herbaceous and arboreal crops, by dry and irrigation methods of cultivation; the raising of cattle, from

the point of view of the pastoral system; forest system (in particular protection against winds and the fixation of sand dunes) and the agricultural system.

(*b*) Study of the different species of plants cultivated in Tripoli and of those existing in other parts of North Africa and elsewhere, which might be introduced with advantage.

(*c*) Economic and agricultural study of the formation of irrigated and dry plantations; that is to say, the relative costs of starting and working these two systems.

(*d*) Meteorological service which will include a central observatory, six district observatories, and sixteen stations at which temperature and rainfall will be recorded.

The Administrative Section will have its Office at Tripoli, and will be in direct connection with the administrative units in the various districts. The Technical Section will have its Office outside the oasis of Tripoli, at the former Turkish Agricultural School, and will have under its control experimental stations suitably distributed over the various districts in addition to the meteorological service for the whole region.

In the Colonial Budget for the financial year 1914-15 the sum of 716,000 lire has been included for carrying on the work of the Department. This sum will be increased during future years as the various services are established or improved, and will assist in increasing the importance of Italian colonization in Tripoli.

[Discussion.]

Professor P. Carmody (Director of Agriculture, Trinidad): Mr. President—The papers we have heard this morning are extremely interesting, and the only fault that I have to find is that we have only about an hour to consider them. There is a great deal in them that one would have liked to have studied beforehand, and I think it would be advisable to consider whether something more than a mere abstract of the papers should not be provided where the subject is of unusual importance. The two subjects that we have had this morning are so large that it is really difficult to do justice to them, unless we had a previous opportunity of considering the views that were to be expressed by the readers of the papers. The paper by Dr. van Hall is full of suggestions, and so is the paper by Mr. Dudgeon from Egypt. Now what I would like us to do at some future Congress would be to study the methods of organization in connection with Agricultural Departments that have been adopted by the different nations. I think if we had the results before us of the work done by different nations in different tropical countries we should be

able to understand better the suggestions that might be made for improvement in any individual country. If we take our own British Empire, within the last eight or ten years, there have sprung up Departments of Agriculture in almost every part of it. Take the West Indies. I think we have had five Departments of Agriculture established within the last ten years, and when you remember that our revenues are small, and that the area from which we can draw men is very limited, I think you will appreciate that the amount of money expended by these small colonies is very great in comparison with what is being spent by larger countries. From an intimate knowledge of what has been done in the West Indies during recent years, and coming home to England and looking round, and seeing what has been done here, I am inclined to this opinion —that in proportion to our revenues we are doing a great deal more for agriculture in the small Colonies than is being done in England itself. I am really astonished at the backwardness of English agriculture in the parts that I have seen, and at the want of agricultural organizations throughout some parts of the country.

I would like, Sir, to mention in connection with your Presidential Address that you seemed to think that the work done by the Departments of Agriculture in our Colonies is not up to as high a level as you think it ought to be. Well, perhaps to a certain extent I will agree with you in that, but you must remember that we are young departments. We are trying to evolve a system that will be suitable to each of our Colonies, and we have had to do it with a very small amount of money, and, as I said before, with very limited material to draw upon for assistance. We have the greatest difficulty, even when a big problem arises, to get assistance in the Mother Country. Much of our work perhaps has not been heard of yet, because it is, as you know, inadvisable for us to publish results before we have something definite to report. Take the case of the frog-hopper problem, with which you are acquainted, and which we have been studying for the last ten years. We have not quite finished our researches in relation to that problem yet, but we have done a great deal of work and spent a considerable amount of money in connection with it. We have employed local entomologists to study the question, and two special experts have been employed also to study it on behalf of the sugar proprietors. As you are aware, Sir, it is extremely difficult to obtain an expert in any part of the world at the present time to study a new problem like that, and I would assure you that from what I know of the work that is done in the Departments of Agriculture in our own Colonies, we are making what I would say is satisfactory

progress, if you will make allowance for the conditions under which we are working.

Another point I would like to mention is this: that I think the members of our International Association for Tropical Agriculture would be brought a little more closely together if it were made a definite rule that we should exchange publications with each other as an international body working on the same lines. Of course, as you know, most of us do so at present; but I think if it were made a general rule that every member of the Association who is conducting experimental work should send his publications to every other member of the International Association we should be in closer touch with each other, and when we met at the end of four years we should know a great deal more about each other's work even than we do at present.

The President: I should like at once to dispel any impression there may be that I underrate in any way the agricultural work that has been done in the British Colonies by Government Departments of Agriculture. On the contrary, I have the greatest admiration for that work. What I wished to emphasize was that, owing to lack of funds at present, it was not possible to provide adequately for research; and what I wanted to indicate was that more money ought to be allotted for that purpose. Professor Carmody has quite rightly said that a very large amount of excellent work has been done with very small endowment, and I expressed that very definitely in my Address. I quite agree with him in thinking that we do want to get information as to how the Government Departments of Agriculture in all tropical colonies are organized, the salaries paid to their officers, and the total amount put at their disposal by their respective Governments. I think that is a piece of information which would be exceedingly useful in many directions, and I am going to suggest to Professor Carmody that if he thinks it desirable to put that into the form of a resolution, it might be carried out by means of a Committee appointed for getting all that information together. I am not aware of any publication at the present time which gives us these facts.

Sir James Wilson: Mr. President—With reference to the particular point of collecting information as to research in tropical countries, I do not know whether members of this Congress are fully aware that we have an institution already in existence at Rome for that very purpose. That institution, the International Agricultural Institute, has been established by all the governments of the world, including most of those countries which have tropical colonies, and very considerable information is furnished to it

about all that goes on in relation to agriculture in every country. Now that is the very body to collect this information. It published the other day a monograph on the services of different phytopathologists—that is to say, on the arrangements different countries have made for obtaining information on this subject, and that was obtained by the Governments themselves. Now the very best means that this tropical Congress has of getting such information is to address the International Agricultural Institute at Rome—which has a staff always there—and ask them to collect through their Government delegates the information which you desire. I am sure from the experience I have had of the Institute, and from conversations with my fellow delegates on the Committee there, that the Institute would receive such an application with pleasure, and the delegates would probably impress it upon their Governments. I make this as a practical suggestion, which I think would form the best means of carrying out the proposal which Professor Carmody has put forward.

The PRESIDENT: I think it might be considered whether the International Agricultural Institute at Rome would be able to do what Professor Carmody has in view; but I would like to point out that at the discussion on phytopathology which took place the other day (p. 107) it appeared that the Agricultural Institute at Rome had proposed a Convention which would not be applicable to some tropical countries, and that specific information with regard to tropical countries had not been collected by the Institute of Agriculture at Rome. I pointed out that the International Association for Tropical Agriculture, under whose auspices this Congress meets, is very considerably older than the International Agricultural Institute at Rome, and was specially formed to deal with matters connected with tropical agriculture. If by means of co-operation with the International Agricultural Institute at Rome our work could be simplified, no doubt it would be a good thing, but whether the International Agricultural Institute at Rome is exactly the best body to discuss what has been done in regard to tropical agriculture is a matter upon which I am not convinced. We have already an association for collecting such information—our own International Association for Tropical Agriculture—but I think the suggestion of Sir James Wilson is one which ought to be considered by the Committee appointed to determine the best way of getting what we wish.

Dr. E. J. BUTLER (Imperial Mycologist, India): With regard to Sir James Wilson's observation and the President's explanation, the volume which Sir James Wilson referred to was a complete account of the organization of phytopathological

work in the Colonies. Last year I contributed the section for India, and it gave in detail all the information with regard to phytopathology. What I understand Professor Carmody wants is information as to the departments as a whole. The volume I refer to simply dealt with phytopathology, but I think there is no reason why the organization at Rome should not do for the whole subject what they have done for one section. It is an excellent organization for the countries adhering.

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): I might point out that many of the tropical Colonies are not affiliated with the Institute at Rome. I remember distinctly about two years ago we had a communication from the Institute at Rome suggesting affiliation, but as regards Nyasaland and many other tropical countries we are not affiliated, because we understood the Institute in Rome had more to do with temperate agriculture than with tropical agriculture. I do not think myself that Professor Carmody would obtain anything like a full account of research work in tropical agriculture through that body with its present affiliation.

Sir James Wilson: On that point it is quite true that at present the British Crown Colonies, with the exception of Mauritius, are not directly represented on the International Agricultural Institute at Rome. But the Institute does pay attention to the agriculture of the whole world, and, of course, the British delegate on the Permanent Committee, although he does not directly represent the Crown Colonies, sees that their interests are not entirely forgotten. Also, when the Institute collects information about agriculture, it not only collects it from the fifty-four Governments who adhere, but it collects information from other Colonies as well. The other day I was asked for information from Uganda about bees. We do collect information from the whole world, and if this Congress were to ask the International Agricultural Institute at Rome to collect information as to what are the present arrangements for research work in the different countries of the world, I have no doubt we should find means to collect information on that subject, and that the International Agricultural Institute at Rome would do it in a far better way than this particular Association would, because I understand this Association is hardly a permanent body, always working, with a large staff and a large income, such as the International Agricultural Institute at Rome has. They are in a position to keep constantly at work, and to collect information such as that in the best way in which it is possible to be done.

Professor Carmody: The resolution I desire to propose is, "That a Committee of this Congress be appointed to collect

information as to the organization, actual work and cost (including salaries paid to officers) in connection with Government Departments of Agriculture in each tropical country."

Mr. McCall: I beg to second that.

The President: It might also be an instruction to the Committee to consider whether co-operation should be secured with the International Agricultural Institute at Rome on this matter. I will now put the resolution.

The resolution was put to the Congress and carried.

Professor Carmody: I move also "That arrangements be made for exchange of publications between the members of the International Association for Tropical Agriculture."

Lieut.-Colonel Collens: I second that.

This resolution was put to the Congress and carried.

FRIDAY, JUNE 26.—AFTERNOON SESSION, 2.30 P.M.

Section III.—Cocoa and Tobacco.

Chairman: Sir Hugh Clifford, K.C.M.G., *Governor of the Gold Coast.*

The following papers were read:—

THE QUALITIES IN CACAO DESIRED BY MANUFACTURERS.

By H. P. Booth and A. W. Knapp,
of Messrs. Cadbury Bros., Ltd.

[Abstract.]

It is by no means easy to make a definite statement which is generally applicable, because the various manufacturers look for different qualities, and cacaos from certain districts are prized for special purposes. There is, further, some danger in describing a desirable appearance, for it is not the appearance that is wanted, but the qualities that are associated with it.

In general, we believe that if the planter only allows ripe pods to be gathered, ferments for a reasonable period, cures with care, and keeps the beans dry, they will have the right appearance, and that he will be producing the best that the types of trees on his plantation will produce. It is evident from this statement that the value of claying and dancing is called in question.

We understand that *unfermented* cacao finds purchasers, but fermented cacao always obtains the higher price; unfermented beans are more difficult to shell, and they produce an inferior cocoa. Partially fermented beans suffer from the same defects. With over-fermented beans the shell may become so loose as to be fractured in carriage and handling.

This opens the way for attack by grubs and moulds. This danger may also be incurred: (1) With over-ripe beans in which the germ penetrates the shell; (2) by washing, which leaves the shell tender; and (3) by lack of care in curing.

Cacao may be spoilt by not observing conditions of cleanliness during fermentation, or by exposing to bad odours. On curing these defects may be hidden, only to be revealed again on roasting, when the objectionable "hammy" or other flavour is developed.

Other objectionable features are the presence of twig-like pieces of dried pulp and placenta, and of small flat beans.

Criollo cacao obtains a higher price than Forastero or Calabacillo, because, while it is the rarest, it is a valuable ingredient of good chocolate. Large beans are preferred because they have a lower percentage of shell than small beans.

Probably the most highly appreciated quality is constancy or reliability of quality. A cacao which varies from bag to bag, or from time to time, will get little appreciation. Under ideal conditions standard qualities would be put on the market—Criollo, Forastero, Calabacillo would be fermented separately, and the beans graded according to size. Such a procedure would only be practicable where the cacao from several plantations was taken to a central fermenting station. At the present time we are far from this. Indeed, instead of a careful grading of good qualities, there is in practice a mixing of good and bad. Thus merchants buy cacao which they know to be diseased or unfermented, and deliberately mix it with good cacao. Such an action may not seriously affect the price of that particular lot, but it affects detrimentally the reputation of the cacao from that district, and the manufacturer regards that cacao as less desirable.

It is to be regretted that in some places cacao is still taken to the steamer in surf boats. Well-prepared cacao thus becomes wet with sea-water, and may later be spoilt by mould.

THE GOLD COAST COCOA INDUSTRY.

By W. S. D. Tudhope,
Director of Agriculture, Gold Coast.

[Abstract.]

Since 1911 the Gold Coast (including Ashanti) has been the largest cocoa, or "cacao," producing country in the world. She first figured as an exporter in 1891, with the modest quantity of 80 lb. weight. The industry has developed with

marvellous rapidity, and during the past year 113,239,980 lb., valued at £2,489,218, were exported.

The farms are owned and cultivated almost exclusively by natives.

Many initial mistakes have been made in the formation of plantations and in the preparation of the cocoa, but the spread of education amongst the farmers has already effected a considerable improvement, and the general quality of the product becomes yearly better.

The soil and climatic conditions are well suited for cocoa culture.

Insect pests and fungoid diseases have been the cause of a considerable amount of damage to plantations, and are now, and must always be, matters of grave concern in a country like the Gold Coast; their depredations do not readily discourage a people who from time immemorial have been accustomed to shifting rather than permanent cultivations.

The industry is greatly hampered through want of cheap and efficient transport within the Colony. The bulk of the transport at present is by means of head-loads, and, in spite of a considerable influx of labourers from adjoining territory during the harvest season, much difficulty is often experienced in getting the cocoa conveyed to the port of shipment.

This transport is arranged, for the most part, by the mercantile community who have penetrated the bush and erected stores or buying-depôts there.

Railways and roads are being rapidly extended and will in time to a great extent alleviate this.

All sections of the community are interested in cocoa culture, and, unless some unforeseen circumstance should intervene the exports already great should yet be much greater.

The following table of exports, at intervals of five years, serves to show the rapid and steady development of the industry: —

Cocoa exported from the Gold Coast.

Year	Quantity (lb.)	Value (£)	Value of increase in five years (£)
1891	80	4	—
1896	86,754	2,276	2,272
1901	2,195,571	42,837	40,561
1906	20,104,504	336,269	293,432
1911	88,987,324	1,813,468	1,277,199
1913	113,239,980	2,489,218	875,750*

* Increase in two years only.

COCOA IN THE SOUTHERN PROVINCES AND COLONY OF NIGERIA.

By W. H. Johnson, F.L.S.,

Director of Agriculture, Southern Provinces, Nigeria.

[Abstract.]

The following subjects are dealt with: The introduction of cocoa; progress of the industry; cultivation; diseases, fungoid and insect; preparation for market; artificial drying experiments; unfermented, artificially dried cocoa; anticipated development of the industry.

Cocoa was first introduced to Nigeria some thirty-four years ago. The distribution of plants and seeds in the Lagos district commenced shortly after the establishment of the Lagos Botanic Station in 1887.

The first shipment of cocoa was made in 1891. In 1900 the exports of cocoa amounted to 4,042 cwts.; last year (1913) they had increased to 72,428 cwts.

The trees do not receive much cultural attention; shade trees are not planted, and pruning and mulching are neglected.

Diseases are not more common than in other cocoa-growing countries, and it is considered that those which do exist could be kept in check by the adoption of proper cultural and sanitary methods.

More care is required in preparing the crop for market. Fermentation is more generally practised than hitherto, but the period of fermenting and curing is too restricted.

Experiments conducted by the Department of Agriculture prove that: (*a*) The value of cocoa can be increased as much as 4s. per cwt. by extending the fermenting and curing period; (*b*) the quality of cocoa dried in a rotary drying machine compares favourably with that dried in the sun; and (*c*) unfermented cocoa can be prepared in this machine superior in quality to ordinary West African cocoa.

With the new areas planted and the instruction given to farmers by the staff of the Department of Agriculture, it is considered that a large increase in the exports of cocoa will take place in the next few years.

THE CULTIVATION OF COCOA IN MAYUMBE (BELGIAN CONGO).

By J. CLAESSENS,[1]
Colonial Office, Brussels.

[ABSTRACT.]

Cocoa-growing is extending in Mayumbe. Actually there is an area of 8,750 acres of cocoa trees, from one to fifteen years old. In 1903 Mayumbe exported 89,565 kilogrammes of cocoa beans. Now about 1,000 tons are exported.

The country is characterized by a dry season of four to five months' duration. This defect is partly rectified by a rather damp atmosphere. During the dry season fogs and dew are abundant, and the sky is very often clouded. The annual rainfall varies more or less between 1,1000 and 1,800 mm. (44 in. to 72 in.).

The variety of cocoa mostly cultivated in Mayumbe is the Amelonado of San Thomé. Until recently, shade was procured from trees which had belonged to the primitive forest. Trials of cultivation without shade were unsuccessful.

Among the enemies which sometimes occasion important damage to the cocoa trees in Mayumbe are *Salberghella singularis* (cocoa-tree bug), and a fungus (*? Diplodia cacaicola*), which attacks the trunk.

The principal defects noticed in the cultivation of cocoa in Mayumbe, and also the improvements that should be adopted, may be stated briefly as follows:—

(1) The planters do not as a rule cultivate their soil sufficiently to make it deep and pervious.

(2) When clearing the land more care should be taken to preserve a part of the forest on the top of the hills. In the flat parts of the country with impervious sub-soil, the forest should also be maintained along the banks of rivers subject to overflow. It is very useful to keep some groves of trees to act as wind breaks.

(3) The soil is often left uncovered after clearing by fire instead of being sown with rapidly growing plants, preferably leguminous. Close plantation, to cover the soil as rapidly as possible, is not common enough. The size of the planting holes is often not sufficient in the heavy soil.

[1] This paper was read for the author by M. E. Leplae, Director-General of Agriculture, Colonial Office, Belgium.

The planting is not done sufficiently carefully, the cocoa trees being often planted with a part of the stem in the earth.

(4) Shade is necessary during the first three or four years. The plantain or banana is well suited for this purpose; also, at the beginning, pigeon pea.

Permanent shade may not be indispensable, but it is very useful and profitable in a dry-season climate such as that of Mayumbe.

Forest shade trees should not be kept; it is much better to use artificial shade which can be better regulated.

Mixed planting of cocoa trees with palm or coconut trees is recommended.

Diseases and insects are now being studied by Government specialists. In the case of *Salberghella* good results have been obtained by getting native children to catch the insects by hand.

NOTES ON SOME EXPERIMENTAL RESULTS IN CACAO CULTIVATION.

By Professor P. Carmody,
Director of Agriculture, Trinidad.

[Abstract.]

This paper gives a preliminary account of some of the experiments in progress under the supervision of the Department of Agriculture in Trinidad, on various problems connected with the cultivation of cacao. The results are summarized in a series of tables. Eight of these tables deal with the natural yield of dry cacao per tree, one with the weight of dry cacao produced per pod, and one records analyses of cacao soils taken from adjacent plots in a field under experiment for natural yield. The interest of the paper lies mainly in the details given in these tables, which will be reproduced when the paper is printed.

A short account is also given of the system of agricultural education in Trinidad and of the means adopted by the Agricultural Department for distributing information on agricultural subjects, and stimulating interest in agriculture among the peasants.

COCOA CULTIVATION IN FERNANDO PO.

By Emilio Gomez Flores,

Director, Agricultural Service, Las Palmas, Canary Islands.

[Abstract.]

This paper records analyses of (1) soils from cocoa estates in Fernando Po, (2) cocoa beans grown on these estates, and (3) the ashes of fruits from cocoa trees in the island.

The results show that the soils of the island are deficient in lime, and that this lack of lime renders the trees peculiarly liable to the attack of *Botryodiplodia theobromae*. It is suggested that this difficulty should be overcome by the use of limestone from Corisco Island, as a source of lime for use on the plantations.

[Discussion.]

Professor Perrot (Ecole Supérieure de Pharmacie, Paris): Dans les notes publiées par moi sur la question de fermentation du cacao, j'ai envisagé cette fermentation à un double point de vue: (1) celui de simplifier si possible la préparation en la rendant plus méthodique, plus rigoureusement scientifique, sans augmenter le prix de revient; (2) celui de fournir à l'industrie consommatrice un produit régulier, de qualité toujours comparable.

Le traitement de la pulpe par le carbonate de potasse montre seulement qu'on peut se débarrasser de cette pulpe plus aisément qu'on ne paraissent le croire, car il ne faut pas oublier que la méthode de fermentation, telle qu'elle est pratiquée actuellement, est en somme presque aussi primitive que du temps des anciens Mexicains.

Des recherches que j'ai pu faire, il me paraît resulter que cette fermentation n'est pas utile pour obtenir un produit industriel. En effet, si dans un espace clos approprié, où l'on place des graines de cacao fraîches, on fait arriver un courant de vapeur d'eau et que sous une légère pression on laisse ces graines en contact avec cette vapeur, les graines sont stérilisées—stabilisées comme nous disons—et dorénavant incapable de subir spontanément aucune action chimique.

Par stabilisation à la vapeur d'eau sous pression, pendant

dix minutes, on obtient des graines qui, lavées et brossées pour enlever la pulpe, sont alors sechées et se conservent ensuite très bien, sans aucune modification, et en conservant leur belle couleur violette naturelle.

Il y avait lieu de se demander, si des graines aussi traitées étaient utilisables par l'industrie du chocolat, car on prétendait que la saveur de la graine était donnée par la fermentation.

J'ai donc fait stériliser à la Côte d'Ivoire 200 kg. de cacao, et l'ai soumis, par l'intermediaire d'une des plus grosses firmes françaises de chocolat, au traitement industriel.

A l'étonnement de celui qui fut chargé de la torréfaction, le cacao devint odorant et ne le cedait en rien aux produits obtenus par fermentation dans la même region.

Voici donc une série d'expériences montrant que la fermentation du cacao ne semble pas utile pour obtenir un excellent produit industrilisable; je crois pouvoir dire que la stérilisation aurait l'avantage double de ne pas élever les prix de revient et de plus assurerait aux industriels une régularité remarquable dans la production de chaque plantation.

[*Translation.*]—In the notes published by me on the question of the fermentation of cocoa, I have considered this fermentation from two points of view: (1) That of simplifying if possible the preparation by rendering it more methodical and more rigorously scientific without increasing the net cost of production; (2) that of supplying to the consuming industry a regular product always of uniform quality.

The treatment of the pulp by carbonate of potash shows that this pulp can be more easily removed than would appear believable, for it must not be forgotten that the method of fermentation as at present practised is almost as primitive as in the time of the ancient Mexicans.

From researches which I have been able to make it appears that this fermentation is not necessary in order to obtain an industrial product. In fact, if a current of steam at low pressure is led into a suitable enclosed space in which fresh cocoa beans have been placed, and the beans are left in contact with the steam, the beans become sterilized—stabilized, as we say—and are thereafter incapable of spontaneously undergoing any chemical change.

By stabilization in steam under pressure for ten minutes beans are obtained which, after being washed and brushed to remove the pulp, are dried and will then keep in good preservation without change, whilst at the same time retaining their fine natural violet colour.

There is good reason for asking if beans thus treated could

be used in the chocolate industry, for it has been claimed that the flavour of the bean is obtained by fermentation.

I have therefore had 200 kilograms of cocoa sterilized at the Ivory Coast and have submitted it through one of the largest French chocolate firms to industrial treatment.

To the astonishment of those who were entrusted with the roasting the cocoa became fragrant and was in no respect inferior to the products obtained by fermentation in the same region.

Here, therefore, is a series of experiments showing that the fermentation of the cocoa seems to be of no advantage for obtaining an excellent product for manufacturing purposes, and I believe that I may say that sterilization would have the double advantage of not raising the net cost of production, whilst it would also assure to manufacturers a remarkable regularity in the production of each plantation.

Mr. J. Maxwell-Vaughan: Mr. Chairman and Gentlemen—I feel sure it will interest you to hear something of the method in general use throughout the Republic of Colombia in connection with cocoa cultivation as practised there from time immemorial. I have not heard of the system being employed in other countries, nor have I seen any mention of it made in books. The point is the employment of irrigation during the flowering period and at intervals until the fruit is "set." This takes place during the dry season. The principal crop is gathered in June, and the secondary, or "metaca" crop, as a rule of smaller dimensions, in December. The object of irrigation is not only to maintain moisture in the soil, which is generally an alluvial loam and porous, but also to counteract the effect of what we call "hielo" (equivalent to frost), which settles in the clear moonlight nights during these dry months. The presence of water in the plantation prevents the frost nipping the flower and young fruit. This may seem odd where the mean temperature is in the region of 85° F., but the nights are as desperately cold at this period as the days are excessively hot. These plantations extend between latitudes 2° and 10° N. at an altitude varying between 100 ft. to 1,000 ft. above sea level. It would be interesting to know in what other parts of the world this system is practised.

There is a disease which has decimated these plantations in the last twenty years, and the cause has not yet been ascertained, for although isolated attempts have been made to remedy the evil, no concerted action has been taken, which is much to be lamented. The disease first becomes evident

by the highest branches withering, and this process continues until the entire tree is invaded and dies in the course of a year or so. Sometimes it attacks odd trees, at others groups, but the result is ever the same—death. The malady is vulgarly known as "gorgojo," or weevil, as perforations appear, but whether a weevil is the cause remains to be ascertained. I am inclined to think the evil starts in the root, judging from the way the extremities of the branches first succumb.

If a practical expert on cocoa diseases would undertake to examine and point out the remedy for this evil, he would not only render a signal service and enhance his reputation thereby, but I am certain that the Agricultural Society of Bogotá would remunerate him handsomely.

Mr. S. H. Davies (Messrs. Rowntree and Co.): Mr. Chairman—I would like first to congratulate you on the extraordinary results which have accrued under your Governorship in the production of cocoa on the Gold Coast. The economic importance of that result is not confined to your Colony, but is of enormous importance to the industry. I wanted to say a word about the only debatable point, and that is the curing and preparation of cocoa. An immense amount of nonsense has been written on the fermentation of cocoa, but we know that the actual principles which underlie the fermentation of cocoa are extremely simple. It is exactly like the fermentation of any fruit. In the first few hours of fermentation you have the organisms which are found on the pod at the time they are cut down; these are known locally as wild yeasts, and they grow first. Then their place is taken by a true yeast, which gives rise to a very large amount of alcohol. That is finally replaced by other organisms, and especially by an organism which is brought to the pods by the vinegar fly. Bearing this in mind, I think with every respect to my distinguished French colleague who spoke of replacing fermentation by sterilization by steam, that the latter would not effect all the objects gained by fermentation. In fermentation in a close mass you have the products percolating all the time through the skin, and modifying the cocoa. It is true that with sterilization, if you allow plenty of air to play on the cocoa you can do all that is necessary in the way of changing the violet or slate coloured bean to a brown or red bean, but you do not get the products of alcoholic and acetic fermentation percolating into the bean. I think that we are now rather at the parting of the ways; it is being suggested on many hands that it would be well to do away with fermentation and to replace it by immediate drying, but these methods are not in themselves sufficient entirely to replace fermentation, and

will not give the same results. At the same time if I were a Gold Coast planter I should not ferment my cocoa, because the difference in price is so extremely small. It is, I think, the fact that you can dry the fermented beans to a very much greater extent than the unfermented, and if any of you carry out quantitive determinations on cocoa estates you will find it absolutely true that a considerable and unrealized loss of weight takes place, and that is why, with every wish in the world to do so, I cannot honestly recommend that every man should necessarily ferment his cocoa. It is extremely unfortunate that owing to causes I cannot go into here, the prices of different grades have drawn together, and now there is a very small difference in price between the good and bad qualities. I think if I were a planter and had steam available I should adopt Professor Perrot's method. I would steam the beans, and subject them to a temperature not exceeding 140° F., and so get a brown or a red bean, and at the same time gain something in the way of a pleasant flavour. I would commend that to the attention of the Congress.

Dr. H. A. A. NICHOLLS (Dominica): Mr. Chairman—The question I wish to raise is that of shade for cocoa. I will illustrate its importance by some facts concerning two islands close together in the West Indies. Trinidad has been associated with the cocoa industry from time immemorial, and nearly the whole of its cocoa estates have an immense amount of shade on them; indeed, cocoa cultivation there is practically the undergrowth of a forest. I think in many instances shade trees are planted before the cocoa. Now going from there to Grenada, an island well known in regard to its cocoa products, you find nearly the whole of the cocoa is planted without shade. Now we have heard from Professor Carmody—and we could not hear it from a higher authority—that the yield of dry cocoa in Trinidad is about 2 lb. per tree, but in Grenada the yield is nearer 5 lb. than 2 lb. I remember about twelve years ago at an Agricultural Conference at Trinidad at which your Chairman and I were both present, the question of shade was brought up, but the discussion did not proceed very far, because nobody there knew much about it. I understood that experiments were about to be undertaken in Trinidad regarding the effect on the productivity of cocoa trees of shade and no shade, but I am not aware that anything has been published. The question deserves serious consideration in view of the difference in yield of 3 lb. per tree to which I have referred. I need hardly tell you that this difference means probably the difference between a profit and a loss.

Mr. H. A. TEMPANY (Superintendent of Agriculture, Leeward

Islands): Mr. Chairman—I should like to ask Professor Carmody in relation to the very interesting results from Trinidad, showing the natural yield of ten adjacent plots, whether there is any record of the source of the seeds from which the various plots, Nos. 1 to 10, were obtained. If it is the case that there is an enormous difference of yield in terms of pods per tree, amounting in the case of plot No. 1 to 798, and in the case of No. 9 to 2,201, it would be interesting to know whether it was a case of variation in the seed. In the Leeward Islands, where we have had a set of manurial experiments, we did not find when the experiments were first commenced any great difference shown in that case, so that in the instance given by Professor Carmody there is rather a remarkable difference to account for. Another point is this—in relation to the return of yields from cocoa plants in terms of pods or lbs. of cocoa per tree, we find that the actual number of trees per plot must vary to a considerable extent on account of the actual fertility conditions of the plot itself—that is to say, a plant in thoroughly good heart will start in full bearing even on a plot in which the fertility of the land is not high. Also it will depend to a certain extent on the actual physical type of soil. For that reason we have during the past two years abandoned the idea of returning the results in pods or lbs. of cocoa per tree, and have made our returns in lbs. per acre, an attempt being made in each case to ascertain the best number of trees which will fully cover the ground in the cocoa plantations without overcrowding or leaving undue gaps, and in that way we have arrived at a fairly satisfactory way of returning results from our experiments.

Monsieur E. Baillaud (Secretary, Colonial Institute, Marseilles): The difference of yield in different plots has been mentioned. May I ask if any experiments have been made with a view to correlating the yield with the physical condition and chemical composition of the soil?

Professor P. Carmody: In answer to the last question I would say this—that the area does not exceed two acres altogether in ten plots—that is, 500 trees on about two acres of ground, and that the mechanical analysis of the soil shows that the plots are exactly alike, or as nearly alike as plots can be. The field was chosen at the foot of a hill, and planters whom we have taken to the plot have all agreed that the soil is of uniform quality. Our chemical and mechanical analyses both point to that.

With regard to what Mr. Tempany said as to the seed that was sown on these plots I need not remind him, as he comes from the West Indies, of the conditions under which cocoa is

grown in Trinidad. Cocoa is grown in the first case by contractors, and I need not tell you that the contractor does not select his seed, and never did. It is only now we are beginning to select seed. The consequence of the old method is that the yield of our cocoa trees has varied very much. With regard to his other criticism, that pods per tree is not a very good method of calculation, I would point out that there is not the slightest difficulty in getting the number of lbs. per acre if you have the pods per tree, and the reason we have elected to take pods per tree is that there is a varying number of trees per acre, in Trinidad at any rate. It is owing to that fact that we have adopted the method of taking pods per tree, leaving it to the particular cultivator to work out the yield per acre. I believe myself in yield per acre, but we want to get the small cultivator to understand what he is doing. With regard to what Dr. Nicholls said as to shade, we have conducted some experiments, but I have not given any details, because the experiments have not arrived at a stage where I can advantageously do so. We have taken shade completely from trees 7 to 9 years old, and from trees 30 years old, and we have taken shade half away from another similar lot of trees, and we are now trying whether we can do altogether without shade. I would also remind Dr. Nicholls of what he already knows: that the flowers of the Immortelle are of considerable manurial value; they return at least about 30 lb. of nitrogen per acre, whilst the nitrogen taken up by the cocoa bean is not more than 15 lb. per acre. There is, therefore, some ground for allowing the Immortelle tree to remain as a shade tree. At the same time we have all arrived at the conclusion that there is too much shade in Trinidad. With regard to the difference in yield between Grenada and Trinidad, I would remind Dr. Nicholls that in Grenada cultivation is very much better carried out. The cultivators manure their trees in Grenada to a much greater extent than they do in Trinidad. In the experiments where we have removed shade from 7 to 9 year old trees a large quantity of new leaves have been formed, and they have shaded the ground as well as, or better than, the Immortelles.

I should like to make one remark with regard to claying mentioned by Mr. Knapp. Claying has lately been made a great deal of as a question of adulteration. As a matter of fact, we are satisfied that a small covering film of clay is *beneficial*, and from the commercial point of view, if we use only a small percentage of clay and produce beans of a better quality, we sell those beans at a higher price than if we did not use the clay, so there is the answer to that question.

The following papers were taken as read:—

THE PRODUCTION OF TOBACCO IN NYASALAND.

By J. STEWART J. McCALL, P.A.S.I., C.D.A.Glas.,
Director of Agriculture, Nyasaland.

[ABSTRACT.]

Progress of the industry since its inception. Climatic factors necessary for the successful cultivation of the crop. Discussion of effect of character of soil on quality of leaf and yield per acre, and of the effect of green-manuring on the crop. Preparation and care of nurseries. Planting and field management. Harvesting. Curing. Bulking. Marketing.

THE CULTIVATION AND FERTILIZATION OF TOBACCO IN THE UNITED STATES.

By W. S. MYERS, D.Sc., New York.

[ABSTRACT.]

The paper treats first of all of general considerations; then historical outline; tobacco-growing in America; preparation of the seed-bed and fertilizers for young plants; character of lands; cultivation, topping, curing tobacco; function of nitrogen in tobacco-growing; and results in American Experiment Stations.

THE CULTIVATION OF TOBACCO IN THE VORSTENLANDEN OF JAVA.

By Dr. H. JENSEN.

[No abstract supplied by the author.]

A SHORT SURVEY OF THE WORK OF THE TOBACCO TESTING STATION IN DELI.

By Dr. L. P. DE BUSSY.

[No abstract supplied by the author.]

A SHORT SURVEY OF TOBACCO CULTIVATION IN BESOCKI, JAVA.

By Dr. A. J. ULTÉE.

[No abstract supplied by the author.]

FRIDAY, JUNE 26.—AFTERNOON SESSION,

2.30 P.M.

Section IV.—Oils and Oil Seeds.

Chairman: Professor Dr. W. F. BRUCK, *Professor of Tropical Agriculture, University of Giessen.*

PALMÖL IN DEN DEUTSCHEN KOLONIEN.

Von DIREKTOR FR. HUPFELD, *Deutsche Togo-Gesellschaft.*

[ABSTRACT.]

DIE Oelpalme, die wichtigste Kulturpflanze des tropischen Westafrika dringt ostwärts nur bis zu den grossen Seen vor. Sie ist daher für Deutsch-Ostafrika nur von untergeordneter, für Togo und Kamerun dagegen von sehr grosser Bedeutung. In Togo findet sie sich in grösseren in Süd- und Mitteltogo, in Kamerun sehr viel in den Urwäldern der Tiefländer.

Die für den Eingeborenen wertvollsten Produkte der Oelpalme sind Palmwein, Palmkerne und Palmöl, von denen letztere beiden zugleich wichtige Ausfuhrartikel sind. Die bisherige von den Eingeborenen angewandte Methode der Palmöl- und Palmkernegewinnung ist sehr primitiv, das Oel hat meist über 20 procent Fettsäure und ist daher in Europa nicht für Speisefettfabrikation, sondern nur in der Seifenindustrie verwendbar.

Da Palmkerne meist nur im Zusammenhang mit Palmöl gewonnen werden und von den Eingeborenen nur wenig selbst verbraucht werden, gibt die tatsächliche Palmkernausfuhr einen Anhalt zur Schätzung des mindestens erzeugten Palmöls in den dem Handel erschlossenen Gebieten. Daraus ergibt sich, dass in Togo wie Kamerun mehr als Vierfünftel des insgesamt erzeugten Palmöls von den Eingeborenen selbst verbraucht und nur knapp 1/5 ausgeführt werden.

Die Palmölausfuhr von Kamerun ist mit run 3,000 t. sehr gleichmässig, die von Togo zeigt infolge der Einwirkung zeitweilig auftretender Dürreperioden zwischen 400 und 4,000 t.

Ein Einfluss der Marktpreise auf die Höhe der Ausfuhr lässt sich nicht feststellen.

Eine Steigerung der Ausfuhr ist zu erzielen durch folgende Massnahmen:

1. Ausdehnung des ausfuhrfähigen Gebietes durch Verbesserung der Verkehrswege (Bau von Eisenbahnen).

2. Intensivere Ausnutzung der vorhandenen Bestände durch bessere Kulturmethoden.

3. Bessere Ausnutzung der erzielten Ernten durch bessere Aufbereitungsmethoden.

4. Vergrösserung der vorhandenen Bestände durch vermehrte Tätigkeit der bisherigen oder Heranziehung neuer Produzenten (europäischer Plantagenbau).

Besonderes Interesse bieten die im letzten Jahrzehnt ausgearbeiteten maschinellen Erntebereitungsmethoden, von denen das von der Agupflanzung in Togo angewendete Verfahren das zur Zeit beste Palmöl liefert von nur 5-6 procent Fettsäuregehalt. Erst diese neueren Methoden machen es möglich, die Oelpalmenkultur auch in der Form des europäischen Plantagenbaus aufzunehmen.

[TRANSLATION.]

PALM OIL IN THE GERMAN COLONIES.

The oil palm, the most important cultural plant of tropical West Africa, occurs eastwards only as far as the great lakes. Accordingly, it is only of subsidiary importance for German East Africa, but of very great importance for Togo and Kamerun. In Togo compact masses of the palm are to be found in the southern and central districts, and in Kamerun there are very many of them in the virgin forests of the lowlands.

The most valuable products of the oil palm for the native are palm wine, palm kernels, and palm oil, the two latter being at the same time important articles for export. The methods hitherto employed by the natives for obtaining palm oil and palm kernels are most primitive; the oil produced in the two countries mentioned contains as a rule over 20 per cent. of fatty acid, and is therefore not suitable for use in Europe as a foodstuff, but only for soap manufacture.

As palm kernels are for the most part only obtained in connection with palm-oil extraction and are only used to a small extent by the natives themselves, the actual export of palm kernels supplies data for estimating the minimum quantity of palm oil produced in the districts open to trade. From this it appears that both in Togo and Kamerun more than four-

fifths of the total quantity of palm oil is consumed by the natives themselves, and barely one-fifth is exported.

The export of palm oil from Kamerun remains steadily at about 3,000 tons, whereas in consequence of periodically occurring periods of drought the export from Togo fluctuates between 400 and 4,000 tons. It cannot be stated whether the market price affects the quantity exported.

An increase in export may be attained by the following measures:—

1. An extension of the districts capable of exporting by improvements in the means of communication (construction of railways).

2. A more intensive utilization of the existing palms through better methods of cultivation.

3. A better utilization of the crops obtained through improved methods of preparation.

4. An increase in the existing number of palms by increased activity of the present producers or by the introduction of fresh producers (European plantation cultivation).

The methods of preparing palm oil by machinery that have been elaborated within the last decade are of special interest, among which the process employed at the Agu plantation in Togo supplies the best palm oil obtained at the present time, containing only 5 to 6 per cent. of fatty acid. These methods make it possible for the cultivation of the oil palm to be taken up in the form of European plantations.

[DISCUSSION.]

Mr. J. H. J. FARQUHAR (Conservator of Forests, Nigeria): Mr. Chairman—For nearly ten years I have been in Nigeria, where the whole wealth of the country is derived from agricultural and forest products. The natives in the Southern Provinces of Nigeria have their farms on which they grow food, but for their wealth they rely on the oil palm. Their methods, however, are very crude; and one of the things which, in my opinion, will assist in increasing the export of palm oil is the importation and use of cheap de-pulping machinery. It would also be a great advantage to have mechanical presses for removing the oil from the pulp, because in the hand method used at present the native cannot apply sufficient pressure to extract anything like all the oil. In a great many cases the nuts are not cracked, and consequently the kernels are not available for export. It is clear from all this that one of the chief things necessary to extend the trade is simple machinery, and in that respect we need the help of engineers. Most of the hand machinery now available is too expensive for the

native, and too heavy to be carried about easily. In Nigeria we now have a railway from Lagos to Kano, and one from Port Harcourt right through the oil-bearing tracts of the northern provinces. In this region the natives are very fond of the oil as an article of diet, so the railway, in a certain section, takes oil north from the coast. Hence we find that there is a zone in which no merchant is able to buy oil for export at a price which would allow him to make a profit. That is one of the factors which will, in all probability, influence the export of this oil to Europe.

In Nigeria there is nothing done in the way of cultivation of the oil palm; and I consider that is a pity, because it is probable that by this means the quality and yield could be improved. Though I would not say there are as many species as Herr Hupfeld speaks of, there are distinct differences in the palms met with, and I think there should be methodical attempts at cultivation; there should be selection, and only the best variety should be grown. With regard to the palm oil itself, everything at present is left to chance, and the method of preparation adopted by the natives is very bad; they allow their fruits to ferment very much, and in that way there are produced hard oils which contain a large percentage of acid, and these kinds are not liked on the markets. That is a consideration chiefly for the European merchant on the coast, for when buying he should exercise discretion, and employ some simple chemical test with a view to finding out what percentage of acid the particular oils contain. I also think that in West Africa people should be very careful in introducing new crops. We have the oil palm, and a practical monopoly of that in the whole world; and when cocoa or rubber, or both, are introduced, it means that in connection with the two latter every man who is put to work on them is taken away from the palm oil industry.

Mr. J. Allan (Messrs. Crosfields, Warrington): Mr. Chairman and Gentlemen—I have listened with the greatest pleasure to the address which has been presented to us by Director Hupfeld, and I should like to ask him one or two questions in the course of the remarks which I propose to make. He has mentioned a yield of 16 per cent. of oil being obtained, and the cost of working the plant in the plantation. I hope he may be able to tell us what percentage of the actual existing oil in the palm fruit has been obtained. I understand he has obtained 16 per cent. of oil from the total weight of the fruit worked. I should much like to know what is the loss of oil, or how much oil existed in the fruit to begin with, because when we know that it will give us a measure of the efficiency of the plant which he has described. The author has suggested

that improvements in the yield might be arrived at by intensive cultivation and otherwise improving the whole agriculture of the palm, so that it may be systematically planted and cultivated, as we would do with any crop at home. This, I understand, has already been tried, more particularly in the German Colonies. Though I have not myself been through the German Colonies, I am told by people who have gone there —and I have travelled in other palm-bearing Colonies, so I speak with some information on the matter—that where selected nuts or fruits have been planted, the palms from these nuts do not always strike true to the palm from which the seed has been obtained; in other words, it would appear as if many of the so-called varieties of palms were "sports" rather than true varieties, and when the trees from these seeds are in their turn cropped it does not of necessity follow that the fruits collected from the newly planted trees are exactly of the type from which these were derived. Perhaps the Director has some further information on this subject which may clear some of the doubts that I have heard expressed on the question of whether the improvement of palm trees by selection of seed is possible.

Another point which the author mentioned concerned the existence of free fatty acids in the palm oil as we get it to-day. It was a very common thing, as the Director has said, to obtain palm oil containing 20 per cent. of free fatty acid; but in the course of an extended experience in connection with palm oil I have found a considerable improvement in the quality of the palm oil which is being shipped to this country to-day. Formerly the palm oil which came from the Bona and Old Calabar districts contained 20 or 25 per cent., and sometimes as much as 30 per cent. of free fatty acid. That was an average applied to shipments extending over a number of years. But to-day a much more accurate general figure would be 15 to 17 per cent. Of course, I do not say that even now exceptional parcels might not run to 20 or even 25 per cent.; but if you take the average run of shipments coming from those countries to-day, you will find that 17 per cent. of fatty acid will more nearly express the figure. Lagos oils, which were formerly represented as the best, are decidedly worse in many cases than the better oils which are coming from Togo and Old Calabar; they are as good as the more frequently quoted "Best quality Lagos," so it would appear that the native is being awakened to a knowledge of the damage he does to his industry and his own product by defective methods of production; and it would also seem that our Government Departments of Agriculture are bringing points forward to the native which will result in his improving the quality of the

raw material. Certainly there is distinct evidence of improvement in the quality from the point of view I have mentioned.

Mr. FARQUHAR, replying to a question by Mr. Barrett (Bureau of Agriculture, Philippine Islands), said: I have myself eaten a good deal of palm oil, and I have never felt any ill-effects from it. But the important point is to see that you get oil extracted by your own servant from a fresh bunch of fruits. The native is nearly always eating oil, and I have not seen among the natives a case of indigestion or other ill-effects. The native is much more particular over the oil he buys for food than over that he prepares himself for export. The oil used as food is always the pericarp oil; kernel oil is very seldom made or used, and then only for lamps.

Mr. R. B. MILLER (Miller Bros., Ltd., Liverpool): Can the author of the paper give us information regarding the supply of palm fruits to factories? Does he anticipate that he will have to plant palms in order to get sufficient fruits to keep the factory going? It is a very important question in regard to the erection of palm oil plant, and it would be interesting to know what the experience in that respect of the author's company has been.

Herr HUPFELD: Das wirkliche Ausbringen, d.h. das Verhältnis zwischen dem tatsächlich gewonnenen und dem in den Früchten enthaltenen Palmöl, lasst sich noch nicht genau festellen, weil der Ölgehalt der Früchte sehr schwankt.

Vermeidbar würde wohl der Verlust sein an Palmöl, das in den Fasern bleibt. Seine Gewinnung-vielleicht in einem Extraktions verfahren—lohnt sich bei kleiner Mengen nicht. Wenn man es gewinnen könnte, würde die gesamte Palmöl Ausbeute um ½ procent, also auf 16½ procent steigen.

Die Sortenfrage ist noch nicht genügend geklärt. Sehr wichtig aber ist bessere Kulturmethode betreffend Pflanzweite, Einschränkung von solchen Zwischenkulturen, die den Boden stark erschöpfen, Vermeidung des Brennens in der Pflanzung.

Eine Verwendung von Palmöl in der Speisefettfabrikation ist erst rentabel bei einem Säuregehalt unter 8 procent, eine Verbesserung des Qualität des Eingeborenen-Palmöls von 23 auf 18 oder selbst 14 procent wurde nicht genügen.

Sehr interessant ist die Beobachtung, dass in Nigeria Palmöl vom Süden nach dem Norden verfrachtet wird, bei dem Bau einer Togo Nordbahn würde es ähnlich werden.

[*Translation.*]—The actual yield, that is to say the ratio between the amount of palm oil contained in the fruit and that really obtained from them, cannot yet be exactly determined, because the amount of oil contained in the fruit varies very greatly.

It would probably be possible to avoid the loss arising through the palm oil remaining in the fibres. Its recovery—perhaps by a process of extraction—does not pay with small quantities. If it could be recovered the total yield of palm oil would be increased by ½ per cent., *i.e.*, to 16½ per cent.

The question of varieties has not yet been made sufficiently clear. Very important too is an improved method of cultivation in respect to distance in planting, the restriction of such intermediate crops as seriously exhaust the soil, and the avoidance of burning in the plantation.

The utilization of palm oil in the manufacture of edible fats only becomes feasible if its acidity is below 8 per cent.; an improvement in the quality of native palm oil from 23 to 18, or even 14, per cent. would not suffice.

It is very interesting to note that in Nigeria palm oil is forwarded from the south to the north; it will be the same on the construction of a Northern Togo railway line.

THE PHILIPPINE COCONUT INDUSTRY.

By O. W. Barrett,

Chief, Division of Horticulture, Bureau of Agriculture, Philippine Islands.

[Abstract.]

The following aspects of the Philippine coconut industry were briefly discussed: The reason for the extreme difficulty experienced in purchasing Philippine coconut plantations. The "cacique" system was explained, and the faulty title system of land holding was discussed and illustrations of this given.

Reasons for the low quality of Philippine copra were discussed, the long rainy season in the principal coconut belt rendering sun-drying very precarious during most of the year, thus bringing about extensive use of the tapáhan, or smoke kiln; the short-sighted policy of Chinese traders and European agents in the field, who pay as much for poor half-dried copra as for the good article, being also to blame in a measure for this execrable custom.

Reasons for the limited quantity of copra exported from the Philippines were given: Too close planting, use of the very large number of trees in oil and "vino" production being the principal factors.

A résumé of the present status of copra, prices of copra, oil, and "tuba," and statistics of production were given.

A few remarks on the labour question and its peculiar disadvantages in the Philippines.

A discussion on the steam-pipe, hot-air oven, and its future place in Philippine agriculture was brought up.

Reference was made to the author's pamphlet, "The Philippine Coconut Industry" (*Bulletin* No. 25: Bureau of Printing, Manila), which gives full information on this subject.

[Discussion.]

Mr. Barrett, in reply to a question by Mr. Lowitz as to the price paid to the labourer, said: It depends very much on the locality and on the time of the year. For instance, in the province of Lacuna, which is the oldest coconut area of large extent in the world, where the palm was plentiful long before any such thing as copra was known, the native does not eat the coconut. Those coconuts were planted for vino or oil, and it was only recently that the export of copra began in that province. There, as it is heavily populated, you can get a good labourer for a shilling a day in most months of the year. But if you want a labourer at rice planting, or rice harvest time, or at sugar time, you will have to pay 50 per cent. more. In the Southern Islands it is difficult to get a good labourer at any price; you may have to pay up to one peso per day throughout the year. In the Saboo you have to pay 1s. 6d. to 1s. 9d. per day, and that does not include food. The labourer generally looks after himself. You cannot get a steady sure supply of labour anywhere at any time. If you try to make contracts and to ensure having steady labour supplies, you will, in many cases, find yourself tied up with the old custom of demanding money advances.

The Chairman: I would like to ask Mr. Barrett whether the further development of the coconut industry in the Philippines has affected the area devoted to the cultivation of Manila hemp.

Mr. Barrett: No, it has not affected the industry in any way, generally speaking. In very few cases they are growing hemp with coconuts, but only in one of the islands, and in the south-east part of the main island, where hemp is the prime crop. They are not planting many coconuts, because the good ground available is under cultivation with other crops. Practically only in one part do you find hemp and coconuts planted together, and that is in a very narrow fringe in the south and round the coast, because nobody thinks of going into the interior, where there is no transport and the natives are dangerous.

In reply to a question by Mr. Wernham as to the yield per acre of coconuts and the cost of planting, Mr. Barrett said: Without going into details, I will give you a very few facts.

In my opinion, fifty good selected trees per acre is the optimum, as we call it. If you put on forty trees per acre, you may get a larger tree, and a few more nuts off each; but you must then remember that you will be ten trees short per acre; and if you get 100 or 150 nuts per tree that is a pretty good production. If you put 75 palms per acre, it is certainly too much. So although some are planting the trees only 30 or 33 feet apart, I think that, considering everything, 50 feet is the proper distance in ordinary more or less sloping, but not quite level soil. Coconuts should not be planted on quite level soil. It is impossible to say what the steady yield per acre will be until you know the soil thoroughly, and how the trees are behaving. Probably 100 nuts per tree, or about 5,000 per year per acre, is not going very far out of the way for a plantation which is neither best nor worst, but is moderately clean. We get 250 to 300 nuts per tree in parts where the soil is exceptionally rich and well-watered. But the general average in one part is below 30, probably not more than 20 nuts per tree. But even that is not an estimate for all places, because I have shown you photographs of over-planted areas, where half the trees will be without any nuts at all, and have been in that condition, perhaps, for years. Even on the Penal Constitution Farm there are trees nine and ten years old which have not shown any sign of fruiting yet. This is often due to bad drainage, to scum and mess on the surface of the soil. But generally speaking, on a moderately well cultivated plantation, 100 nuts is not too much. It takes 250 to 325 nuts to make a picul, and there are 16 piculs to the ton. Some claim, with very large nuts, 200 to a picul. But during one year, when the soil had to do without rain, the nuts were so small that some of the factories said it took 500 of the nuts to make a picul. It is impossible to give the cost per acre until we know how much forest there is to be cleared, and how much grass there is on it to uproot, and how much you have got to pay for your labour. But those figures are worked out in the pamphlet I have mentioned (*Bulletin* No. 25: *The Philippine Coconut Industry*, Bureau of Printing, Manila, Philippine Islands.).

In reply to a question by Mr. Allan on the subject of the steam-drying of copra, Mr. Barrett said: There is no large plant there for drying. Nearly four years ago I devised a steam oven with steam pipes, and we made a model of it, and sent it to the Second Philippine Exposition, and it has been copied in a few cases; though not so many as one could have wished, and they were very cheap copies. We made ours of sheet-iron and asbestos; we had steam-pipes running under trays, and they were working very well. They turn out fairly

dry copra in six, seven and eight hours; it should be ten hours to be thoroughly dry. But, as the superintendents say: Why should we dry our copra when others are selling it wet and getting as much for it? There will be a time when there is a fixed standing for dry copra. There are only five of these modern driers working now, and they turn out not more than 50 piculs per day. As I was leaving, they were extending their plants, and putting in extra ovens. Fuel for feeding the ovens costs nothing, because the husks and shells are used for fuel, and the water pipes are good for years. They dry their copra at no more expense than cutting it up and putting it on the presses.

RICERCHE SULLE VARIETA DI OLIVO DELLA TRIPOLITANIA.

Per. Dott. Oberto Manetti,

Vice-Direttore dell'Istituto Agricolo Coloniale Italiano.

[Abstract.]

L'autore, che ha visitato la Tripolitania facendo parte di una recenti missioni scientifiche agraria che attraversato la nuova Colonia Italiana, riferisce in questa sua memoria gli studi fatti sulle varietà di olivo coltivato in colutra asciutta nella Tripolitania Settentrionale e più propriamente in quella regione, che va sotto la denominazione indigena di "Gebèl."

Premesse poche notizie sulla diffusione e sulla cultura dell' olivo in Tripolitania e sull'importanza che attualmente ha questa pianta, dovunque l'irrigazione non può economicamente effettuarsi, l'autore riferisce i dati analitici che egli ha ottenuto studiando le varietà di olivo dello Msellata e del Garian, che sono i distretti più importanti, dal punto di vista della coltura dell'olivo, di tutta la Tripolitania. Nel lavoro vengono riportate determinazioni morfologiche sulle foglie, notizie sul portamento delle piante, rapporti tra il nocciolo dei frutti e la polpa, misure varie sulle olive, ecc. Sono ben 26 varietà di olive della Tripolitania che sono state esaminate dall'autore.

Nel lavoro non si conclude con una completa identificazione delle razze coltivate in Tripolitania, non bastando le scarse conoscenz che attualmente si posseggono sull'agricoltura della regione ad una definitiva classificazione degli olivi coltivati nell'altopiano della Tripolitania.

Però le ricerche già iniziate sulle varietà, a cui è lasciato il nome col quale sono distinte dagli indigeni, segnano un primo e notevole contributo, primo passo necessario ad un completo stulio da farsi nell'avvenire.

[TRANSLATION.]

EXAMINATION OF THE DIFFERENT VARIETIES OF TRIPOLI OLIVES.

The writer, who visited Tripoli as a member of the recent Scientific Agricultural Commission which travelled through the new Italian Colony, refers in his memorandum to the studies carried out with respect to the varieties of olives cultivated by the dry method in Northern Tripoli and more particularly in that region which goes by the native name of "Gebèl."

After some preliminary information on the distribution and cultivation of the olive in Tripoli and on the importance which this plant has at present in places where irrigation cannot be economically carried out, the writer refers to the analytical data which he has obtained by studying the varieties of olives in Msellata and Garian, which are the most important districts in the whole of Tripoli from the point of view of the cultivation of the olive. Morphological data with respect to the foliage, notes on the yield, relations between the kernel of the fruit and the pulp, various measurements of olives, etc., are given in the paper. Quite twenty-six varieties of Tripoli olives have been examined by the writer.

No accurate identifications of the different varieties are arrived at in this work, as the little knowledge we have at present of the agriculture of the district is not sufficient for definitely classifying the several kinds of olives cultivated on the high plateau of Tripoli.

The researches already commenced with respect to the said varieties, for which the names used by the natives are retained, signify, however, a first and notable contribution to, and the first necessary step for, a complete study to be carried out hereafter.

The following papers were taken as read:—

RISULTATI ANALITICI DI ALCUNE RICERCHE SUGLI OLI TRIPOLINI.

Per Dott. ALESSANDRO MORESCHINI.

[ABSTRACT.]

Dall'esame di 26 campioni di olive e di 3 di oli provenienti da diverse regioni della Tripolitania, risulta che:—

1°. Il contenuto in estratto etereo greggio delle polpe di olive variò da 17 a 49·31 per cento di polpe secche.

2°. Il contenuto in materie non saponificabili variò da 1·57 a 8·69 per cento di estratto etereo greggio.

3°. Il contenuto in acidi grassi liquidi (espressi come acido oleico) variò tra 87·17 e 51·50 per cento di estratto etereo delle polpe; da 67·48 a 48·71 pure per cento di estratto etereo nei noccioli e da 72·51 a 67·93 per cento negli olii.

4°. Il metodo di estrazione (per pressione o per sbattimento nell'acqua) sperimento sulla stessa varietà di olive non mostrò dare olii sensibilmente diversi.

5°. Nella stessa varietà di oliva la composizione della polpa e del nocciolo, non presentano tra loro differenze tali da consigliarne la separazione nella estrazione dell'olio.

6°. Notevole il contenuto in acido stearico dell'olio di polpa e di nocciolo della varietà "ghanimi."

7°. Fu sempre negativa la reazione di Alphen e di Beaudoin riscontrata su alcuni olii della Tunisia.

[TRANSLATION.]

ANALYTICAL RESULTS OF SOME RESEARCHES ON TRIPOLI OLIVE OILS.

From the examination of twenty-six samples of olives and of three samples of oil from various regions in Tripoli, the following results were obtained:—

1. The amount of crude ethereal extract from the pulp of the olives varied from 17 to 49·31 per cent. of the dry pulp.

2. The crude ethereal extract contained from 1·57 to 8·69 per cent. of non-saponifiable substances.

3. The amount of liquid fatty acids (expressed as oleic acid) varied between 87·17 and 51·50 per cent. in the ethereal extract from the pulp; from 67·48 to 48·71 per cent. in the ethereal extract from the kernel; and from 72·51 to 67·93 per cent. in the oils.

4. The methods of extraction (by pressure or by beating in water) which have been tried on olives did not appear to cause any considerable differences in the oils produced.

5. There is not such a difference in the composition of the pulp and that of the kernel as to make a separation in extracting the oil advisable.

6. The amount of stearic acid in the oils from the pulp and the kernel of the "Ghanimi" variety is noteworthy.

7. The reactions of Halphen and of Beaudoin gave always negative results.

LA CULTURE DE L'OLIVIER EN TUNISIE.

Par R. Koël,

Ingénieur agronome, attaché à la Société Nationale d'Encouragement de l'Agriculture.

[Abstract.]

De toutes les productions arboricoles de Tunisie, l'olive devrait être à la place d'honneur; malheureusement, on se heurte trop souvent à l'incurie et même à la mauvaise volonté des indigènes.

Voici quels sont les derniers chiffres donnés par l'administration des douanes françaises: —

Exportation sur la France en 1911: —

Huiles d'olive	2,486,580 francs	Total 2,857,664 francs.
,, de grignons d'olive ...	371,084 ,,	

Quant à la consommation indigène, on ne saurait indiquer un chiffre, les renseignements étant pour ainsi dire impossibles à procurer, malgré toute le zèle et toute l'intelligence de nos administrateurs coloniaux.

En général on plante les arbres de 24 mètres en 24 mètres, soit 17 oliviers à l'hectare, ce que facilite les cultures intercalaires et sont nécessités en outre par la sécheresse et la chaleur du climat tunisien.

Ce que l'on doit surtout chercher à obtenir c'est une culture plus rationnelle de l'olivier. Souvent l'indigène se contente de récolter mais pas d'entretenir. La taille est presque inconnue, malgré les efforts des moniteurs habiles délégués par le gouvernement.

L'on doit en outre abandonner radicalement le système qui consiste, pour éviter le déchaussement, à entasser au pied de l'arbre des ramilles et des branches cassées qui sont surtout des refuges pour les insectes. Seul le buttage doit être utilisé.

Les variétés, très nombreuses mais mal ou pas sélectionnées, sont à remplacer par des variétés bien choisies et bien acclimatées. De la sorte, au lieu d'arbres de petite taille, rabougris, couverts de mousses, on aura des olivettes de grand rendement et permettant, grâce à la hauteur des fûts, une intercalaire facile et rémunératrice.

La récolte par gaulage, qui abîme les arbres, doit être remplacée par la cueillette à la main, qui, si elle nécessite un peu plus de main-d'œuvre, ne compremet pas les récoltes suivantes.

Enfin les procédés d'extraction de l'huile par la méthode

indigène sont à rejeter complètement. Le serrage insuffisant laisse trop d'huile dans les grignons.

La culture de l'olivier est cependant en voie d'amélioration, tout au moins dans la region du Nord, grâce à l'action du gouvernement et des grandes sociétés agricoles. De plus, les officiers chefs de district, à la fois soldats et agriculteurs, enseignent aux Arabes les bonnes méthodes de taille et d'exploitation. Déjà des progrès ont été accomplis, mais il reste encore beaucoup de chemin à parcourir pour rendre à la Tunisie le rang que sous l'occupation romaine elle occupait en Afrique du Nord. Cette rénovation, commencée déjà, est tout à l'honneur des hautes compétences du protectorat, qui certainement ne s'arrêteront pas en si beau chemin dans cette œuvre de civilisation et de progrès.

[Translation.]

THE CULTIVATION OF THE OLIVE IN TUNIS.

Of all the arboricultural products of Tunis, the olive should have the place of honour; unfortunately carelessness and even unwillingness, on the part of the natives, are too often met with.

The following are the latest figures issued by the French Customs administration:—

Exports to France in 1911.

Olive oils	2,486.580 francs	Total 2,857,664 francs
Olive oil cake	371,084 ,,	

Figures showing native consumption cannot be given, as it is impossible to procure the information, notwithstanding all the zeal and intelligence of our Colonial administrators.

The trees are generally planted 24 metres by 24 metres, or 17 olive trees to the hectare. This facilitates intercalary cultivation, and is also rendered necessary by the dryness and heat of the Tunisian climate.

It is necessary above all to endeavour to achieve a more rational cultivation of the olive tree. Often the native is content to gather the produce but not to take care of his trees. Pruning is unknown, notwithstanding the efforts of the skilful instructors provided by the Government.

Further, the system by which twigs and broken branches, which are chiefly a refuge for insects, are piled at the foot of the tree, to avoid exposure of the roots, must be entirely abandoned. Only earthing up is to be adopted.

The varieties, which are very numerous but badly, or not at all, selected, are to be replaced by well chosen and well acclimatized varieties. Thus, in place of trees of small size, stunted, and covered with mosses, we shall have young olive trees of large yield, which owing to the height of the stems will allow of easy remunerative intercalary cultivation.

Harvesting by knocking down the fruit, which destroys the trees, is to be replaced by hand-picking, which, though it necessitates a little more labour, does not prejudice the succeeding crops.

Finally, the processes of extraction of the oil by the native method must be completely rejected. Inadequate crushing leaves too much oil in the cake.

The cultivation of the olive tree is, however, in process of improvement, at least in the northern region, thanks to the action of the Government and of the large agricultural societies. In addition, the chief district officers, who are both soldiers and agriculturists, teach the Arabs good methods of pruning and working. Progress has already been made, but there is still a long road to traverse in order to bring Tunis to the high position it occupied in Northern Africa under the Roman occupation. This revival, already commenced, is greatly to the honour of the authorities of the Protectorate, who certainly will not stop on the way in this work of civilization and progress.

RENDEMENT DU PALMIER A HUILE EN BASSE-GUINEE.

Par L. Nicolas,[1]

Sous-Inspecteur d'Agriculture.

[Abstract.]

L'on sait que l'*Elaeis guineensis* est une des principales richesses de la Guinée française, et qu'on le rencontre en abondance sur toute la côte de cette Colonie.

Les opérations faites par l'auteur ont porté sur un total de 590 arbres récoltés d'octobre 1911 à mai 1912, et dont l'huile, ainsi que les amandes, ont été preparées suivant les procédés indigènes. Il ne s'agit donc pas ici de rendements ayant toute la précision des recherches de laboratoire; mais de rendements pratiques possédant par consequent, dans les circonstances actuelles, un très réel intérêt pour l'exploitant,

[1] This note was presented to the Congress by M. Prudhomme, directeur du Jardin colonial, on behalf of the author.

car ils représentent, non pas ce que l'on pourrait obtenir, mais ce que l'on obtient pratiquement avec les méthodes d'exploitation actuellement en usage en Guinée.

Résultats moyens.

Nombre total des régimes—2,521, pesant	20,100 kilos.
Poids moyen d'un régime	7·970 ,,
,, ,, des fruits contenus dans un régime	4·600 ,,
,, ,, d'huile de palme obtenue par régime, suivant les méthodes indigènes	0·374 ,,
Poids moyen des amandes en coques (noix de palme) contenues dans un régime	2·917 ,,
Poids moyen des palmistes (amandes de palme) contenus dans un régime	0·815 ,,
Production moyenne par *Elaeis* en rapport	4·272 régimes.

Enfin ces constatations, dont on pourra trouver un exposé détaillé dans *l'Agronomie Coloniale* de novembre 1913, ont permis l'auteur d'évaleur à 2·847 fr. la récolte moyenne annuelle d'un *Elaeis* en rappbrt de la Basse Guinée, en rappelant qu'il s'agit uniquement ici de méthodes d'extraction indigènes, qui sont très imparfaites, et en donnant comme valeur à l'huile de palme et aux palmistes les prix de la place du Conakry en 1912-1913, c'est à dire 0·65 fr. pour l'huile rouge et 0·35 fr. le kilo pour les amandes.

[Translation.]

YIELD OF THE OIL PALM IN LOWER GUINEA.

It is known that *Elacis guineensis* is one of the principal products of French Guinea, and that it is found in abundance throughout the coastal region of this Colony.

The operations carried out by the author relate to a total of 590 trees which were worked from October, 1911, to May, 1912, the oil, as well as kernels, being prepared according to native processes. We are, therefore, not dealing with yields having the precision of laboratory researches, but with practical results possessing consequently in the present circumstances a very real interest for the worker, since they represent not what might be obtained but what is practically obtained with the methods of working at present in use in Guinea.

Average Results.

Total number of bunches, 2,521, weighing	20,100 kilograms
Average weight of a bunch	7·970 ,,
,, ,, of fruits in a bunch	4·600 ,,
,, ,, of palm oil obtained per bunch by native methods	0·374 ,,
Average weight of kernels in shells (palm nuts) contained in a bunch...	2·917 ,,
Average weight of palm kernels contained in a bunch ...	0·815 ,,
Average production per palm in bearing	4·272 bunches.

Briefly, these results, a detailed account of which may be found in *l'Agronomie Coloniale* for November, 1913, have enabled the author to estimate the average annual value of an *Elaeis* palm in bearing in Lower Guinea at 2·847 francs; it must be remembered that they relate solely to native methods of extraction, which are very imperfect, and that the value of the palm oil and palm kernels is taken at the prices in the market at Conakry in 1912-13, that is to say, 0·65 franc for red oil and 0·35 franc per kilogram for kernels.

LES FRUITS DU PALMIER A HUILE AU GABON.

Par P. Ammann,[1]

Chef du Service chimique au Jardin colonial.

[Abstract.]

Le palmier à huile est une des richesses du Gabon, mais le commerce et les indigènes n'ont encore pas su en tirer tout parti possible, et de nombreux *Elaeis* ne sont pas encore exploités, même dans les régions côtières facilement accessibles.

Le climat et le sol sont extrêmement favorable au palmier à huile au Gabon, et permettent une fructification abondante estimée à une moyenne de 8 à 10 régimes de 12 kilos, représentant 100 kilos de régimes par palmier et par année. Ces régimes portent d'ailleurs des fruits qui sont plus volumineux que partout ailleurs en Afrique.

Des analyses effectuées sur des échantillons recueillis sur les bords de l'Ogoue ont donné les résultats suivants (*l'Agronomie Coloniale*, 31 janvier, 1914).

1. Rendement des régimes en fruits.

	Poids entier	Fruits humides contenant environ 20 pour cent d'eau	Fruits sèches, 4 pour cent d'eau
	Kilos.	Kilos.	Kilos
Gros régime...	... 20 ...	— ...	9·8 soit 49 pour cent.
Régime ordinaire	... 13 ...	7·8 soit 60 pour cent ...	6·5 ,, 50 ,,
Petit régime...	... 4·85 ...	2·9 ,, 59·7 ,, ...	2·4 ,, 49·4 ,,
,, ,, ...	... 4·40 ...	2·7 ,, 61 ,, ...	2·3 ,, 56·8 ,,

2. Composition des fruits.

Poids moyen d'un fruit: { 1er échantillon = 8 grammes.
{ 2e ,, = 11·2 ,,

Le diamètre des fruits dans les échantillons examinés était presque toujours supérieur à 20 mm. et dépassait souvent 25 mm.

[1] This note was presented to the Congress by M. Prudhomme, directeur du Jardin colonial, on behalf of the author.

3. PROPORTION CENTESIMALE DE PULPE ET DE NOYAU DANS LE FRUIT.

1er échantillon : { Pulpe 38·2.
Noyau 61·8 (coque 43·5 : amande 18·3).

2e échantillon : { Pulpe 20·0.
Noyau 80·0 (coque 63·76 : amande 16·24).

4. COMPOSITION CENTESIMALE DE LA PULPE.

Eau 3·29 à 4·50, matières grasses 77·14 à 65·48.

5. COMPOSITION CENTESIMALE DES AMANDES.

Eau 8·50 à 10·8, matières grasses 45·9 à 47·8.

On voit que ces fruits sont d'un poids très sensiblement supérieur à celui des fruits de la Côte d'Ivoire et du Dahomey. D'autre part, la pulpe est très riche en matières grasses, mais la proportion de coque contenue dans les noyaux est très élevée : —

Coques, 70·4 à 85·5 pour cent ; amandes, 29·6 à 14·45 pour cent.

Le rendement en palmistes est donc faible, et l'épaisseur de coques pouvant atteindre 6 mm. le concassage de noyaux est difficile.

[TRANSLATION.]

OIL PALM FRUITS IN THE GABOON.

The oil palm is one of the most valuable products of the Gaboon, but the trade and the natives have not yet exploited this source of wealth to the fullest extent, and numerous *Elaeis* palms are not yet worked, even in the easily accessible coast regions.

Climate and soil are extremely favourable in the Gaboon to the oil palm, which yields an abundance of fruit estimated at an average of eight to ten bunches of 12 kilograms, representing 100 kilograms of bunches per palm per annum. These bunches, moreover, bear fruits which are more bulky than anywhere else in Africa.

Analyses carried out on samples collected on the banks of the Ogoue have given the following results (*l'Agronomie Coloniale*, January 31, 1914): —

(1) YIELD OF FRUITING HEADS.

	Total weight Kilos.	Fresh fruits containing about 20 per cent. of water Kilos.	Dry fruits, 4 per cent. of water Kilos.
Large head ...	20	.. — ...	9·8, or 49 per cent.
Ordinary head	13	... 7·8, or 60 per cent. ...	6·5, or 50 ,,
Small head ...	4·85	... 2·9, or 59·7 ,, ...	2·4, or 49·4 ,,
,, ,, ...	4·40	... 2·7, or 61 ,, ...	2·3, or 56·8 ,,

(2) Composition of the Fruits.

Average weight of a fruit { First sample = 8 grammes.
Second sample = 11·2 grammes.

The diameter of the fruits in the samples examined was almost always above 20 mm., and often exceeded 25 mm.

(3) Percentage Proportion of Pulp and Nut in the Fruit.

First sample { Pulp, 38·2.
Nut, 61·8 (shell, 43·5; kernel, 18·3).

Second sample { Pulp, 20·0.
Nut, 80·0 (shell, 63·76; kernel, 16·24).

(4) Percentage Composition of the Pulp.

Water, 3·29 to 4·50; fat, 77·14 to 65·48.

(5) Percentage Composition of the Kernels.

Water, 8·50 to 10·8; fat, 45·9 to 47·8.

It is seen that the fruits are very appreciably heavier than those of the Ivory Coast and Dahomey. On the other hand, the pulp is very rich in fat, but the proportion of shell in the nuts is very high:—

Shells, 70·4 to 85·5 per cent.; kernels, 29·6 to 14·45 per cent.

The yield of palm kernels is, therefore, low, and the thickness of the shells being as much as 6 mm., the cracking of the nuts is difficult.

CONTRIBUTION AU PROBLEME DU BUDGET ALIMENTAIRE DE *L'ELAEIS*.

Par M. Gaston Williame.

[Abstract.]

Le problème du budget alimentaire de l'*Elaeis guineensis* présente une grande importance en raison du mouvement qui tend à utiliser pour cette essence, comme pour tant de produits tropicaux jusqu'ici mis en valeur à l'état forestier, les méthodes agronomiques rationnelles d'exploitation.

Ce problème est actuellement très difficile à résoudre, vu que les termes n'en sont pas encore posés exactement: d'une part, une seule analyse complète, celle de Zeller, a été effectuée concernant les matières enlevées par l'*Elaeis* et encore laisse-

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t-elle dans l'ombre certains points utiles; d'autre part les observations et analyses partielles des divers auteurs sont extrêmement divergentes, et malheureusement les indications manquent qui pourraient élucider ces divergences.

Quoiqu'il en soit, m'aidant de la bibliographie existante, j'ai établi sur une base uniforme les 9 tableaux suivants :—

I.—Composition des parties d'un palmier à huile (pour cent) en éléments nutritifs principaux : azote, acide phosphorique, potasse, chaux.

II.—Poids et nombre moyen des diverses parties d'un palmier à huile (chiffres se rapportant en général à la variété commune).

III.—Quantités de matières nutritives enlevées par un palmier à huile (exprimées en kilos d'azote, d'acide phosphorique, de potasse, de chaux).

IV.—Quantités de matières nutritives enlevées par hectare, à raison de 125 arbres.

V.—Quantités de matières nutritives à rendre au sol par an et par hectare en raison des immobilisations permanentes (en plus de tous les déchets et résidus de la plantation et des récoltes).

Résultat total: 18·166 kilos d'azote; 16·785 kilos d'acide phosphorique; 24·876 kilos de potasse; et 3·325 kilos de chaux.

VI.—Quantités de matières nutritives enlevées par les récoltes par an et par hectare (et qu'il faudrait rendre sous forme d'engrais, si l'on négligeait de restituer au sol les feuilles, les déchets de fabrication de l'huile de palme, râfles, coques, tourteaux).

Résultat total: 16 kilos d'azote; 33·125 kilos d'acide phosphorique; 12·750 kilos de potasse; et 4·3375 kilos de chaux.

VII.—Quantités totales de matières nutritives à rendre au sol par an et par hectare.

Résultat total: 141·701 kilos d'azote; 106·765 kilos d'acide phosphorique; 203·328 kilos de potasse; et 13·580 kilos de chaux.

VIII.—Quantités totales de matières nutritives enlevées par hectare et par an, en adoptant les moyennes d'Adam.

Résultat total: 173·826 kilos d'azote; 180·515 kilos d'acide phosphorique; 305·328 kilos de potasse; et 29·068 kilos de chaux.

IX.—Quantités totales de matières nutritives enlevées par hectare et par an en adoptant les moyennes de A. Hallet.

Résultat total: 239·576 kilos d'azote; 334·890 kilos d'acide phosphorique; 44·728 kilos de potasse; et 56·868 kilos de chaux.

[TRANSLATION.]

CONTRIBUTION TO THE PROBLEM OF THE PLANT-FOOD REQUIREMENTS OF THE OIL PALM.

The problem of the plant-food requirements of *Elaeis guineensis* is of great importance in view of the movement for utilizing rational agricultural methods of exploitation for this tree, as well as for many other tropical products hitherto exploited only in the forest state.

This problem is at present very difficult to solve, because its terms are not yet exactly defined. On the one hand, a single complete analysis, that of Zeller, has been carried out in regard to the materials taken up by the oil palm, but certain useful points are still left in doubt; on the other hand, the observations and partial analyses of various authors are extremely divergent, and unfortunately indications which might elucidate these divergencies are wanting.

However, with the assistance of the existing bibliography, I have drawn up the following nine tables on a uniform basis.

I.—Composition (per cent.) of the parts of an oil palm in the principal nutritive constituents: nitrogen, phosphoric acid, potash, lime.

II.—Weight and average number of the different parts of an oil palm (figures referring in general to the common variety).

III.—Quantities of nutritive materials taken up by an oil palm expressed in kilograms of nitrogen, phosphoric acid, potash and lime).

IV.—Quantities of nutritive materials taken up, at the rate of 125 trees per hectare.

V.—Quantities of nutritive materials to be returned to the soil per year per hectare on account of the material permanently fixed by the plants in addition to all the waste and residues of the plantations and crops.

Total result: 18·166 kilos of nitrogen; 16·785

kilos of phosphoric acid; 24·876 kilos of potash, 3·325 kilos of lime.

VI.—Quantities of nutritive materials removed by the crop per year and per hectare (which it would be necessary to return in the form of manure if the leaves, waste from the manufacture of palm oil, stalks, shells and cake were not returned to the soil).

Total result: 16 kilos of nitrogen; 33·125 kilos of phosphoric acid; 12·750 kilos of potash; and 4·3375 kilos of lime.

VII.—Total quantities of nutritive materials to be returned to the soil per year per hectare.

Total result: 141·701 kilos of nitrogen; 106·765 kilos of phosphoric acid; 203·328 kilos of potash; and 13·580 kilos of lime.

VIII.—Total quantities of nutritive materials taken up per hectare per year, adopting the averages of Adam.

Total result: 173·826 kilos of nitrogen; 180·515 kilos of phosphoric acid; 305·328 kilos of potash; and 29·068 kilos of lime.

IX.—Total quantities of nutritive materials taken up per hectare per year, adopting the averages of A. Hallet.

Total result: 239·576 kilos of nitrogen; 334,890 kilos of phosphoric acid; 44·728 kilos of potash; and 56·868 kilos of lime.

GRAINES DE TRICHILIA OU MAFOURAIRES DU SUDAN NIGERIEN.

Par P. Ammann,

Chef de Service chimique au Jardin colonial,

ET

J. Vuillet,

Directeur de l'Agriculture dans le Haut Sénégal Niger.[1]

[Abstract.]

On sait que les Trichilias ne sont pas inconnues au point de vue commercial, puis que le Mozambique exporte annuellement environ 2,000 tonnes de graines du Trichilia, reçues à Marseille sous le nom de "Mafouraire."

[1] This note was presented to the Congress by M. Prudhomme, directeur du Jardin colonial, on behalf of the authors.

M. Vuillet a été amené, dans ces conditions, à étudier les Trichilia de l'Afrique occidentale française et à rechercher si ces plantes donnent des graines exploitables, au même titre que celles de l'Est-Africain portugaise.

Les graines recueillies ont été remises au Jardin colonial et soumises à l'examen de M. P. Ammann.

L'absence de fleurs et de fruits n'a pas permis de connaître l'origine botanique exacte des plantes. Les échantillons ont été classés en trois catégories: —

I. Graines petites de couleur brun rouge foncé.
II. Graines de moyenne taille, vermillon orangé.
III. Grosses graines orangés.

	I	II	III
Poids de cent graines, grammes ...	12·7	29·4	79·1
Humidité, pour cent	6·16	5·64	5·33
Matières grasses, pour cent	37·29	41·93	47·12

Les grosses graines (III) sont celles qui se rapprochent les plus, comme dimensions et richesse en matières grasses, des Mafouraires du Mozambique. Elles atteignent, à l'état frais, 23 × 16 ou 11 mm.—tandis que les Mafouraires de l'Est-Africain portugaise mesurent à l'état sec 20 × 12 mm. en moyenne.

[TRANSLATION.]

TRICHILIA OR MAFOUREIRA SEEDS FROM THE NIGERIAN SUDAN.

It is recognized that the Trichilias are not unknown from the commercial point of view, since Mozambique exports annually about 2,000 tons of Trichilia seeds, received at Marseilles under the name "Mafoureira."

In view of this fact, M. Vuillet has been led to study the Trichilias of French West Africa and to ascertain whether these plants yield valuable seeds similar to those of Portuguese East Africa.

The seeds collected have been sent to the Jardin colonial and submitted to examination by M. P. Ammann.

The absence of flowers and fruits prevented the determination of the exact botanical identity of the plants. The samples have been classed in three categories: —

I. Small seeds of a dark red-brown colour.
II. Seeds of medium size, orange vermilion.
III. Large orange-coloured seeds.

	I	II	III
Weight of 100 seeds, grams ..	12·7	29·4	79·1
Moisture, per cent.	6·16	5·64	5·33
Fat, per cent.	37·29	41·93	47·12

The large seeds (III) are those which most nearly resemble, in dimensions and richness in fat, the Mafoureiras of Mozambique. In the fresh state they reach 23 × 16 or 11 mm., whilst the Mafoureiras of Portuguese East Africa measure in the dry state 20 × 12 mm. on an average.

CONTRIBUTION A L'ETUDE DU "DA" DES SOMONOS (*HIBISCUS CANNABINUS*).

Par J. VUILLET,[1]

Directeur de l'Agriculture dans le Haut Sénégal Niger.

[ABSTRACT.]

L'*Hibiscus cannabinus*, L., est une malvacée annuelle cultivée comme textile en Afrique occidentale française. Son intérêt comme plante oléagineuse paraît moins connu, aussi paraît-il intéressant de donner ici les résultats de l'examen auquel a procédé le Service chimique du Jardin colonial, d'un échantillon de graines récolté a Koulikoro (moyen Niger) et envoyé en France par M. le Gouverneur Clozel.

Graines de forme tetraédrique.—Dimensions: longueur 5 à 6 mm.; largeur 4 mm.; épaisseur 2 à 3 mm. Poids de 100 graines, 2·46 grammes. Proportion centésimal d'albumen et de tegument: albumen, 60·7; tegument, 39·3.

La forme des graines rend leur décortication pratiquement impossible. L'analyse, executé par M. P. Ammann a, en conséquence, porté sur la graine entière.

Eau, pour cent	9·64
Matières grasses, pour cent	20·32
,, azotées, pour cent	21·14
,, saccharifiables, pour cent	15·66

La matière grasse est une huile siccative, de couleur jaune claire, qui pourrait, semble-t-il, trouver un débouché dans l'industrie des couleurs et vernis factices, linoleum, etc. Le tourteau est comestible et pourrait contribuer un bon aliment pour le bétail.

L'espèce de "Da" dont il vient d'être question est le "Da des Somonos." Cette variété est cultivée en bordure du fleuve

[1] This note was presented to the Congress by M. Prudhomme, directeur du Jardin colonial, on behalf of the author.

par les pêcheurs du Niger qui en utilisent la fibre pour la confection des cordes et le calfatage de leurs embarcations.

Le "Da des Somonos" produit approximativement en moyenne 700 kilogrammes de semences par tonne de fibres sèches. L'auteur estime que la production moyenne par hectare peut être évaluée, dans la vallée du Niger, à 700 kilogrammes de fibres sèches par 500 kilogrammes de graines.

[TRANSLATION.]

CONTRIBUTION TO THE STUDY OF THE "DA" OF THE SOMONOS (*HIBISCUS CANNABINUS*).

Hibiscus cannabinus, L., is an annual of the N.O. Malvaceæ, cultivated for its fibre in French West Africa. Its interest as an oil-yielding plant appears less known, and it would seem interesting to give here the results of the investigation made by the Chemical Service of the Jardin colonial of a sample of seeds gathered at Koulikoro (Middle Niger) and sent to France by Governor Clozel.

Seeds of tetrahedric form.—Dimensions: Length 5 to 6 mm.; width 4 mm.; thickness 2 to 3 mm. Weight of 100 seeds, 2·46 grams. Percentage proportion of albumen and seed coat: albumen, 60·7; seed coat, 39·3.

The shape of the seeds renders their decortication practically impossible. The analysis carried out by M. P. Ammann was consequently made on the whole seed.

Water, per cent.	9·64
Oil, per cent.	20·32
Crude proteins, per cent.	21·14
Carbohydrates, per cent.	15·66

The oil is a drying oil of a clear yellow colour, which ought to find an opening in the manufacture of paints, varnishes, linoleum, etc. The cake is edible and would form a good cattle food.

The species of "Da" here referred to is the "Da of the Somonos." This variety is cultivated on the banks of the river by the Niger fishermen, who utilize its fibre for the manufacture of lines and for caulking their boats.

The "Da of the Somonos" produces approximately an average of 700 kilograms of seed per ton of dry fibre. The author estimates that the average production per hectare in the valley of the Niger may be taken at 700 kilograms of dry fibre per 500 kilograms of seed.

THE CULTIVATION OF COCONUT PALMS IN THE INTERIOR OF AFRICA.

By Professor Edm. Leplae,

Director-General of Agriculture, Colonial Office, Belgium.

[Abstract.]

This short note is communicated to the Congress in connection with photographs shown in the Rubber and Fibres Exhibitions at the Agricultural Hall, in order to obtain from other members of the Congress accounts of experience of the cultivation of coconuts at long distances from the sea coast.

The note gives a few data about the climate of central Congo, where some coconut palms show excellent growth, even at a distance of 1,500 kilometres (900 miles) from the sea.

The photographs show these Congo palms together with palms grown at Tabora, 420 miles from the sea, and on the shores of Tanganyika, 600 miles from the sea. Also a date palm grown on Tanganyika.

COCONUTS.

By W. E. F. de Lacy,

Deputy-Recorder of Titles and Judge of Land Registration, East Africa Protectorate.

[No abstract supplied by the author.]

THE FIXED OILS OF CEYLON.

By Alfred Lewis, F.L.S.,

Late Conservator of Forests, Ceylon.

[No abstract supplied by the author.]

SUR LA COMPOSITION DES DIVERSES GRAINES OLEAGINEUSES DE L'AFRIQUE FRANÇAISE.

Par M. Alexandre Hébert.

[No abstract supplied by the author.]

LES EXIGENCES DE L'INDUSTRIE METROPOLITAINE EN MATIERES GRASSES DES COLONIES ET PAYS TROPICAUX.

Par M. Alexandre Hébert.

[No abstract supplied by the author.]

FRIDAY, JUNE 26.—AFTERNOON SESSION,

5 P.M.

The Karakul Sheep.

Chairman: SIR H. HESKETH BELL, K.C.M.G., *Governor of the Leeward Islands.*

THE CHAIRMAN: Gentlemen—We are now to have the pleasure and advantage of hearing a paper on the Karakul fur-bearing sheep of Bokhara by Professor Wallace. It is almost unnecessary to introduce Professor Wallace, because he is so well known. He has for thirty years occupied the Chair of Agriculture at Edinburgh, and his life's work has been mainly devoted to the study of stock, principally in Great Britain, but also in the Colonies, and in tropical countries. Professor Wallace is going to tell us in his paper about those most interesting animals, the Karakul sheep, which, as you all know, give us the Astrachan fur of commerce, about which, I understand, very little has hitherto been published. Nothing of much moment is actually known with regard to these sheep; consequently, I am sure we shall listen with the greatest interest and advantage to the paper which I will now ask Professor Wallace to read.

THE KARAKUL SHEEP—THE PRODUCER OF "PERSIAN LAMB" AND OTHER FURS OF OVINE ORIGIN.

By Professor R. WALLACE, F.R.S.E.,

Professor of Agriculture and Rural Economy, University of Edinburgh.

[ABSTRACT.]

The most important fat-tail, fur-bearing breed of sheep in the world is known as the Karakul, a name applied by Russian dealers to all fur-sheep obtained at the Karakul market. The town of Karakul, so called from the "black lake" (Sart *Kara Kul*), lies not far from Old Bokhara city, the capital of the Khanate, now included in Russian Turkestan. The whole

subject of the origin and history of the breed bristles with errors and conjectures. The sheep of Asia, the sheep continent, are roughly classed as fat-tails and fat-rumps. "Persian lamb," "broad-tail," "Tibetan lamb," etc., etc., are trade designations, and misleading. The chief characteristics of the true breed are the black colour, the beautiful lustre and the tightness of the curl in the new-born lambs' coat, and the absence of under-down. These seem to come from a strain called the Danadar—the "nigger" among fur-bearing sheep. The account of Pallas (eighteenth-century Russian traveller) is still in the main correct. The old story that the ewes were killed for the sake of getting the baby lambs' skin in the best condition is now known to be a fable. The ewes often drop their young prematurely, from the effects of a peculiar disease called "djut." Fur-lambs are killed when a few days old.

The Emir of Bokhara, the chief sheep-master in the Khanate, is an excellent trader (netting about 1,000,000 roubles per annum), but gives little or no attention to maintaining purity of breed. To procure pure Karakuls is almost impossible; even those of Thorer, the great German furrier, show signs of commixture. The old idea that the Karakul lost its characteristics when bred abroad is disproved. The breed has been more or less successfully introduced into the Crimea, North Russia, Germany and German South West Africa, the United States (by Dr. C. C. Young, the greatest English-speaking authority on the subject), and quite recently into Scotland. The Scotch experiment is still in the bud, but promises to lead up to not only a remunerative home-grown fur-industry, but a meat trade as well.

[DISCUSSION.]

Mr. H. J. ELWES, F.R.S.: Mr. Chairman and Gentlemen—I think we ought to feel under an obligation to Professor Wallace for having brought forward this subject, which is one of which I think probably less is known in the agricultural world than almost any other. I have no doubt whatever that if we can succeed in getting hold of the right breed, these sheep might probably be introduced into some of our Colonies, South Australia for instance, to great advantage. But there is one point—and I am sure Professor Wallace will not be angry if I say this—on which I want to make a criticism. I should have liked his paper a great deal better if it had been the result of his own knowledge. I am afraid that in a great part of this paper he has relied upon Dr. Young. I have no personal knowledge of Dr. Young, but after reading various

writings of his on this subject I came to the conclusion that he was absolutely unreliable. I do not want to suggest that Dr. Young writes things which he knows to be untrue, but he has accepted a number of vague statements, and he has stated as facts things which certainly are absolutely different from things which I know myself. And I always say that in any investigation of this sort authority is everything, and if you are not extremely rigid about quoting other people for facts of this sort you are likely to get saddled with all sorts of fancy stories, and you do not know where you are. Now there are various points which, as far as I could gather from Professor Wallace's paper, were taken from Dr. Young, for instance, with regard to the so-called Tibetan sheep. I suppose I saw 100 tons of Tibetan wool in India, and there was not one black fleece in it, and though there are fine-woolled Tibetan sheep, the great majority of Tibetan sheep are kept as beasts of burden, and you might call their fleece hair rather than wool. Then he also spoke of the Afghan sheep being generally red in colour. Now anyone in India has seen any amount of Afghan sheep and lamb skins of various qualities; you can buy them from ten rupees up to 500 rupees; and in not one among them have I seen anything at all of the character that we are accustomed to mean by Persian or Bokhara, or Crimean, or Astrachan lamb. My own impression, after having seen sheep in a great many parts of Asia, and after having studied Pallas, and all the other so-called authorities, is that I have never attempted to learn anything of any subject about which there was so extremely little accurate and reliable information available, because you must remember Pallas travelled nearly 150 years ago, and since his time hardly one line has been written by any man who knew more of the subject than an ordinary traveller might know about the innumerable breeds of sheep in Asia. Now an attempt has been made to distinguish between the so-called fat-tailed sheep and the so-called fat-rumped breeds, and no doubt they are extremely different. But when I asked Professor Wallace just now whether one of his rams which was shown on the screen was shown with the tail of the natural size, and he said it was, I felt sure that ram was just as much a mongrel as any which Dr. Young has introduced. If there is a pure-bred sheep in Asia I have not seen it, because I believe what is said of the inhabitants of Bokhara is true of all those tribes; they are all mongrels—the Mongolian, the Tibetan, and those in North China; I have seen those sheep in the possession of their owners, and there was not one of them in whose flocks I could ever see the slightest trace of care or selection. They seem to breed them as the Shetlanders

breed their sheep; anything that could stand the hardships of the country would suit them; they have to rough it and to starve to an extent which could hardly be understood by anyone who has not been in the country.

Well, I am not going to take up your time by picking to pieces Dr. Young's statements. I am perfectly satisfied that Professor Wallace will be absolutely with me on three points. First of all, that it is most desirable in the interests of tropical agriculture that this question should be investigated, because I think this is much more an animal for sub-tropical countries than for England. I believe that the inherent power of producing skins of this type probably exists in all sheep, but that it has been developed in a special district by environment coupled with selection and climate, and that if we could only go to the fountain-head and get direct a few of the best rams, we could find, I venture to say, much better breeds to cross with them than the one Professor Wallace has already tried. Because if he can succeed at the very first cross with a ram who had "mongrel" stamped on every feature of his character—if he can produce at the very first cross of his ram with two of the coarsest and least lustrous-woolled sheep two such skins as he has shown us on the screen to-night, it would evidently be very much easier to do so with properly selected animals. If I had been going to conduct this work I should have chosen the most lustrous animal I could find, the Wensleydale. Now when I was at Bristol last year I took particular pains to inquire from a Russian gentleman, the principal stock expert of the Russian Government, and although he did not say so point-blank, it was pretty evident to me that the Russians do not mean anyone else to have the right sort of thing, and if we want to get them we must go to Afghanistan. But if we are going to start a new industry, and certainly one which may be a most profitable and valuable industry to some of our Colonies, we shall have to do it through Government support. I myself was prepared two years ago to send a man at my own expense to Bokhara to try to get this sheep, but I found it absolutely impossible. They will not let you have them even if you go in the name of Zoological Gardens. Professor Ewart has tried in vain to introduce the sheep to the Scottish Zoological Gardens, and I believe the Scottish Board of Agriculture would be much more likely to succeed than ours. Here is something which can be done more easily by Scotchmen than by anybody else, because when they have turned their minds to sheep they have always beaten all other nations. And I think if the South African or the Queensland Government would take this up something would come of it. I certainly hope it will not be blocked, because

the rapid increase in the cost of all fur, especially high-class fur, is so great that this is a thing for which the market is assured, and the value will increase very largely. And the extraordinary thing to me is that nobody has ever thought of it before, except that all the best breeders of sheep think their own is the best, and the multiplicity of breeds of sheep in England is too great already.

I hope Professor Wallace will not think I have made these remarks in any spirit of captious criticism, but what I want to impress upon you is this, that unless I know the definite authority for the various things, which have been stated as facts, or stated without definite authority in this paper, I shall have to look upon the origin, history, and peculiarities of the Karakul sheep as a subject still remaining to be investigated.

The CHAIRMAN: As the hour is already late, I propose to wind up this discussion by saying a very few words. I think we have all listened with the greatest interest and pleasure to Professor Wallace's most able paper, and although the last speaker is evidently not quite satisfied as to the reliability of some of the statements which the Professor has apparently made upon the authority of Dr. Young, we have nevertheless obtained a vast amount of information which we had not before, and a great deal of light has been thrown upon a most interesting subject. I think perhaps Mr. Elwes may have missed the statement made by Professor Wallace, that so little was known upon this subject even by those who know most about it, and that Dr. Young himself had had to correct statements made before. He is learning, like anybody else, and I daresay that now he is in a position to state that many of the conclusions he formerly arrived at need modification. I have in my own personal experience in a part of the world where I lived for some years, Uganda, met with sheep of a somewhat similar type to those described by Professor Wallace, and when I saw his pictures just now of some of these fat-tailed sheep, I was struck by their great resemblance to sheep I had seen there. They were rather smaller, perhaps, and a little more hairy, and, as we all know, in tropical countries there is the proverbial difficulty of distinguishing between sheep and goats; but it seemed to me that possibly, as those sheep have fat tails such as those shown in the pictures, they might make a good groundwork on which to raise a cross. I am sure that the Government of Uganda is always alive to the possibility of new industries, and will, when they see Professor Wallace's paper, be struck with the same possibility that has occurred to me. I will conclude by expressing to Professor Wallace our warmest thanks for his most interesting and instructive paper.

Professor Wallace: I should like to say one word before we close. I am quite sure that my lecture would not have been a success unless Mr. Elwes had been here. Mr. Elwes has been my trumpeter for the last thirty years, and I am always quite certain that anything I say will be duly emphasized by Mr. Elwes. But there is one thing in regard to which Mr. Elwes and I do not see eye to eye, and that is in regard to our opinion of Dr. Young. Now Mr. Elwes has never seen Dr. Young. I have travelled and corresponded with Dr. Young, he has advised me with regard to this breed in Scotland, and we have found Dr. Young's practical results come out what he said they would time and again. I do not think Dr. Young is a perfect guide, but he is the best we can get, and when he comes back I am quite sure I shall have a battle royal with him. He has been worrying me every day to change something; he even wanted me to change my lecture to-night. Dr. Young has done great service in this matter; he has been brought up in the business, and I greatly believe in men who have been brought up to a business, and in fact people who come into businesses of this intricate kind, after they have grown up, never make a success of it in my opinion. We are going to stick to what Dr. Young has told us until we get a better guide.

That sheep which Mr. Elwes mentioned happens to have been the only one Dr. Young knew nothing about. That was a sheep which I got from somebody else. When I showed it to Dr. Young he went into ecstasies; he said, "That is the sheep I wanted to get and could not find!" Dr. Young has given me a lot of information, but nine-tenths of the information in the lecture I obtained from other sources, and I know I will have a fight over what I have said when he comes back. It will be a great time when Mr. Elwes and Dr. Young and I get together. The public, at any rate, may now know that at least the three greatest authorities on this question have not settled what they consider the rights and the wrongs of this very important matter. I thank you for the attention and patience with which you have listened to my address, and I hope this is only the beginning of a great industry.

Professor P. Carmody (Trinidad) moved a vote of thanks to the Chairman, which was carried by acclamation, and the proceedings terminated.

SATURDAY, JUNE 27.

Visits to Woburn and Rothamsted.

At the invitation of His Grace the Duke of Bedford, K.G., a party of Delegates and Members visited the Experimental Fruit Farm at Ridgmont, and subsequently inspected the work of the Rothamsted Experiment Station at the invitation of the Trustees of the Lawes Agricultural Trust.

The party left London at 10.5 a.m., and proceeded by rail to Flitwick Station, whence they motored through a part of Woburn Park to the Duke of Bedford's Experimental Fruit Farm at Ridgmont.

The party were here received by the Director, Mr. Spencer Pickering, F.R.S., who conducted them over portions of the Farm and explained the work carried on and the experiments in progress.

After being entertained at luncheon, a short visit was paid to the adjoining Experimental Station of the Royal Agricultural Society, where the experiments in progress were described by the officer in charge.

From Ridgmont the party motored via Dunstable to Rothamsted, where they were received and entertained at tea by Dr. E. J. Russell. The laboratories and portions of the Rothamsted Experiment Station, conducted by the Lawes Agricultural Trust, were visited, and the nature of the experiments was explained by Dr. Russell and the staff of the Station.

The party subsequently returned by train from Harpenden to London, which was reached at 7.35 p.m.

Visit to Kew Gardens.

At the invitation of the Director a party of Delegates and Members visited the Royal Botanic Gardens at Kew in the afternoon. They were received by Mr. A. W. Hill, Assistant Director, Dr. Otto Stapf, Keeper of the Herbarium; and Mr. J. M. Hillier, Keeper of Museums, by whom they were shown round the Gardens. The party was subsequently entertained at tea.

MONDAY, JUNE 29.—MORNING SESSION.

Cotton Cultivation.

Chairman: FIELD-MARSHAL EARL KITCHENER, K.P., G.C.B., O.M., G.C.S.I., G.C.M.G., *Honorary Vice-President of the Congress.*

THE PRESIDENT: Gentlemen—Lord Kitchener, who very kindly promised to take the chair at this meeting, has not yet been able to arrive from the country, and I therefore propose to take the chair until he comes. I will in the first place ask Mr. Arno Schmidt to read a paper on "The World's Demand for Cotton, and India's Share in Meeting It."

THE WORLD'S DEMAND FOR COTTON AND INDIA'S SHARE IN MEETING IT.

By ARNO SCHMIDT,

Secretary of the International Federation of Master Cotton Spinners' and Manufacturers' Associations.

[ABSTRACT.]

Reviewing the potentialities of the cotton-growing countries of the world, one is bound to come to the conclusion that India alone is the country from which the present generation can hope to obtain the additional supplies of raw cotton to meet the ever-increasing demand.

The progress made in Sind, Punjab, North-West Frontier Province, United Provinces, Madras, Central Provinces, Bombay, Burma, Assam, and Baroda, which have been visited by the writer, points to the possibility of increasing the total crop of Indian cotton within five years to about ten million bales, but in order to achieve this the staff of agricultural farming experts under Government employment must be considerably enlarged. The Indian Government could not invest money in a more productive way than by engaging many more of these experts. A comparison of the expenditure of other countries on agriculture shows that an increase in the expenditure for agriculture by the Indian Government

is overdue. The sale of cotton seed on credit, similar to that instituted in Egypt, is strongly advocated for the purpose of supplying the ryots with pure seed, and the licensing of ginning factories in some Provinces is advocated as a means of stopping the mixing of the seed of different varieties. Damping of ginned cotton should be made a penal offence.

Although Lancashire does not use large quantities of Indian cotton, two important advantages arise for the British Cotton Industry from an extension and improvement of cotton growing in India, viz., every additional bale of Indian cotton liberates a bale of American cotton and increases the purchasing power of the Indian cultivator, who is Lancashire's best customer.

[Discussion.]

The Earl of Derby (President of the British Cotton Growing Association): Gentlemen—I should like first of all to congratulate Mr. Schmidt very sincerely on the paper he has read before you to-day, which is one of the greatest possible interest; and to no people is it of more interest than to those of the county from which I come, Lancashire. I can only speak, of course, as a layman, and in an honorary capacity as President of the British Cotton Growing Association. But I have through that Association been brought much into contact with those who are interested in cotton, whether it is in growing or in manufacturing it, and I can assure Mr. Schmidt that we appreciate his paper very much. I should also like, on behalf of the Association, to congratulate the International Federation of Master Cotton Spinners' and Manufacturers' Associations on having followed our lead, which was a lead set not in my time, but in the time of my distinguished predecessor, Sir Alfred Jones, who, in a letter written to Lord Curzon—at that time, very nearly ten years ago, Viceroy of India—advocated very much what Mr. Schmidt advocates to-day. It would naturally be very wrong of me to enter into any discussion of the various points which Mr. Schmidt has raised. I agree with him in one thing—that this question of cotton growing is not to be looked at from a narrow point of view—it is of international importance. And it is from that point of view rather than from the point of view of what I may call Lancashire policy that I heartily endorse what he has said. I cannot myself entirely subscribe to the conclusion that he arrives at with regard to the county of Lancashire; I am not quite so certain that the advantages which he says will accrue to Lancashire will accrue. But I need not go into that. I will only say that from the broader

point of view I cordially appreciate what he has said. I believe that the growing of more and better cotton in India will on the whole conduce to the general prosperity and to the greater prosperity of the cotton manufacturers of the world.

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): Mr. President—I have listened with much interest to Mr. Schmidt's paper. This is by no means the first communication Mr. Schmidt has made to those engaged in the extension of the cotton industry throughout the Empire, and it is very pleasing to hear a man who is so intimately connected with the commercial side of the question giving some praise to the endeavours of the agricultural experts.

M. Brenier (French Indo-China): Mr. President—I did not intend to take part in the discussion on the interesting paper which has just been read, but I venture to put before the Congress a fact which may perhaps interest it. It is that in French Indo-China, in Cambodia, we are going to undertake the scientific culture of Cambodia cotton, which was singled out in Mr. Schmidt's paper as being an interesting variety of cotton. At present there is an annual export from Indo-China of about 5,000 tons of this cotton, which is all taken by Japan. I was very much struck by what Mr. Schmidt told us about the general yield of Cambodia cotton in India. I am not quite sure whether we can put forward the same figures as Mr. Schmidt quoted—500 lb. per acre, if I am not mistaken—but we intend to study the cotton in a scientific way, and have just started a special cotton farm for this purpose. I thought this fact might perhaps interest the Congress.

Sir James Wilson: Mr. President and Gentlemen—I venture to say a few words on this question, because I was Secretary to the Government of India in the Agricultural Department when that letter to which Lord Derby referred came to Lord Curzon, and I had a good deal to do in India with the work of the improvement and encouragement of cotton cultivation which resulted from that letter. I am very pleased to hear that the arrangements then made—about ten years ago, I think, or more—have on the whole turned out very successful. I was astounded to hear of the very large increase in the outturn of cotton in India which is expected this year. I think, if I remember rightly, the figures have gone up from about 3,000,000 bales four or five years ago to an expected outturn of 6,000,000 bales this year. I have not myself been following the recent reports on the outturn of cotton in India, but I should imagine that this great increase in the production which is expected this year must be due not so much to what may be called a normal increase in the growth of cotton, but to an exceptionally favourable season. I am afraid it would be a

mistake to suppose that this record of 6,000,000 bales is to be looked upon as anything like an average, and we must expect some time to elapse before the average yield will be anything like so great. As regards the encouragement of cotton cultivation in India, I know that the Government of India and the local governments have paid a great deal of attention to this matter, and I quite agree with what Mr. Schmidt has said about the native cultivator having improved his methods, his baling, etc. But it must be remembered that the Government of India has to consider not only the problem of the improvement of cotton cultivation in India, but a great many other problems, too. For instance, the Government is pressed by the cotton spinners to improve the cotton of India, it is pressed by the millers to improve the wheat of India, and it has to consider the improvement of sugar cultivation, silk cultivation, and the cultivation of a great many other products, so that it cannot be expected to devote more than a proper proportion of the available income to cotton. The Government has increased very much within the last few years the amount of time and money which it has devoted to cotton, and no doubt it will continue to do as much as possible in that direction, with due regard to the interest of the other products of India, and of the people generally. I quite agree that it would be a great advantage to the people generally if the Government of India would still further increase its interest in regard to the cultivation of cotton, and I hope that it will be able to do so.

There are one or two other points in Mr. Schmidt's paper about which I should like to say a word or two. He is anxious that the Government should make better arrangements for giving a higher price for good quality cotton when it is grown. That is one of the difficulties which lie before the Indian cultivator who is a small man with a small area—that if he does take the trouble to grow cotton of good quality he finds it very difficult to get a better price. Arrangements have been made by the Government with considerable success in this direction, and I am glad the question has been taken up by the Bombay spinners. I venture to think that this is a question in which the International Federation of Cotton Spinners might fairly take a hand, and do more than has yet been done to afford a good market to the small man for his good quality cotton. Mr. Schmidt has also urged, as is very commonly urged, that watering bales of cotton before pressing should be made a penal offence. Now in India we are very reluctant to impose compulsion upon the people. It is far better to do things by way of encouragement than by way of compulsion, and I do not see myself why the spinners should not follow the

example of the millers, who have raised the quality and cleanness of Indian wheat very much during the last seven years by insisting on only getting clean wheat. If the spinners would follow their example by saying that they will only buy cotton which has not been in water, the result will very soon be that ginners in India will not find it worth while to water the cotton, because they will not be able to sell it. It is a matter which rests more with the spinners who buy the cotton than with the cultivators, or even, in a sense, with the ginners. Generally speaking, I agree with Mr. Schmidt's paper, and I am very pleased to find that the arrangements introduced in Lord Curzon's time have turned out very advantageous to the cotton of India, and therefore to the cotton spinners and to the consumers throughout the world.

The PRESIDENT: If there are no other remarks on the paper, I will ask you to accord a very hearty vote of thanks to Mr. Schmidt, whose paper is full of interest to those concerned in the advancement of cotton cultivation in India.

Mr. SCHMIDT: Mr. President—I beg to thank the Congress for the kind expression of appreciation.

I would like to take this opportunity of saying, in reply to the remarks of Lord Derby, that the same advantages that I advocate as resulting for the Lancashire spinners from an extension and improvement of the Indian cotton-growing industry were used by his own Association in the circular of 1904 of which he spoke.

As regards the remarks of Sir James Wilson, I can conscientiously say that the climate in India during the last season has certainly not been specially favourable to the growing of cotton, and there is no reason whatsoever why we should not be able to count upon India supplying six million bales next season, and possibly more. If the sale of cotton seed on the credit system, which Lord Kitchener has introduced into Egypt, were adopted in India, the yield per acre would undoubtedly be increased and the quality improved.

The remarks made by Sir James upon the question of artificial damping are naturally those which theory would dictate. As a matter of fact, it is almost impossible for the spinner to find out who has ginned his cotton. It is bought and sold in the open market, and a bale may often change hands twenty or thirty times. The spinner cannot detect the damp in the cotton until he opens the bale and uses it. Bales are sometimes stored three, four, or five months in the mill, and it is too late then to endeavour to trace the perpetrator of the fraud. The damping of cotton rots the fibres, and where not much water has been used it stains the cotton and reduces its value.

The PRESIDENT: Gentlemen—I am now going to ask Lord Kitchener to preside at this meeting. We welcome him not merely as a great soldier and as a great Imperialist, not only as His Majesty's representative in a country where agriculture is of the first importance, but I think I may say we also welcome him as the owner of an estate in British East Africa, and therefore as a brother agriculturist in the tropics.

Field-Marshal Earl KITCHENER then took the chair, and the following papers were read:—

PROBLEMS IN CONNECTION WITH COTTON CULTIVATION IN EGYPT.

By GERALD C. DUDGEON, F.E.S.,[1]

Consulting Agriculturist to the Ministry of Agriculture, Egypt; Vice-President of the International Association for Tropical Agriculture.

[ABSTRACT.]

The area under cotton in Egypt has increased annually until 32·6 per cent. of the total cultivable lands are under that crop.

Extension of the cotton area is limited, owing to the insufficient drainage of the lands in many parts rendering it compulsory to frequently introduce reclamation crops such as rice. The difficulties occasioned by the incompleteness of the original drainage scheme have made the position, with regard to the undrained lands, almost impossible of amelioration. The salt lands in the north are capable of reclamation, but the work is at present delayed owing to the low Nile, and in any case the lands are not expected to yield large crops of cotton.

The increase of cotton areas has occasioned a corresponding decrease in food-grain areas, the importance of which is demonstrated by a table of production and value. About 95 per cent. of the food grain used in the country is grown in the country itself, in spite of the large areas under cotton, thus showing the great fertility of Egyptian soil.

Although small effect has been yet caused by the introduction of cotton into a rotation of two instead of three years as previously, it is not recommended to increase this frequency, which will result in a diminution of food crops, and a probable deterioration in the yield of cotton itself.

[1] Read in the absence of the author by Dr. L. H. Gough, of the Ministry of Agriculture, Egypt.

A reference to the comparative value of flood and low Nile water as a fertilizing agent is made, drawing attention to the fact that the disintegrated rock which largely comprises the silt is not lost by canal irrigation or reservoirs, as is frequently maintained.

The deterioration in quality of the cotton is chiefly due to Earias boll-worm attacks of the second and third pickings. The effect of the low Nile of 1913 may be experienced in 1915, due to the inability to plant a land-washing crop such as rice in 1914, and the consequent return of salt.

The general stability of Egyptian conditions, the improbability of a permanent decline in the quality of the cotton crop in the near future, and a suggestion of the position of the country without cotton are referred to.

The extension of area and the effect on the quantity of cotton produced having been treated, two important factors influencing the quality are brought to notice: the first, the effect produced by the approximation of a large number of different varieties of cotton plants and the defects in the ginning of the crop; and the second, the occurrence of insect pests, chiefly the boll-worm. In both cases the remedial measures which are being adopted are referred to.

THE IMPROVEMENT OF COTTON BY SELECTION.

By J. Stewart J. McCall, P.A.S.I., C.D.A.Glas.,
Director of Agriculture, Nyasaland.

[Abstract.]

Under this heading a general review of the progress of the Cotton Industry of Nyasaland is set forth, and special attention is directed to the necessity of Government control at the ports of entry, to prevent the promiscuous importation of many varieties of seed.

Careful tests on a Government Experimental Farm are of real value to a new country and form a safeguard against the production of mixed staples, which are practically unsaleable and give the centre of production a bad name.

It is further recommended to use all possible influences to preserve one distinct variety to each district at least, and it is considered after five years of experiment that better results will be obtained by selection from acclimatized stock rather than frequent importations of exotics.

Egyptian varieties are pronounced as unsuitable for elevations in Nyasaland over 1,000 ft. above sea-level, whereas American varieties produce the best staple between 1,000 and 3,000 feet.

The influence of soil, rainfall, and elevation on quality, length, and strength of fibre is discussed, and the high prices for Nyasaland Upland cotton is attributed to seed selection on estates.

Plant characters in relation to selection are fully discussed, special emphasis being laid on the necessity for selecting on the estate as against obtaining seed from a distance.

The undesirable character of boll shedding is considered to be largely hereditary, and types exhibiting this defect can be eliminated by selection.

Branching characteristics of selections are easily established if the seed is pure and a small type of plant is preferred.

Egyptian seed, unlike most American varieties, gives its best results in Nyasaland in the first year that it is sown.

Isolation and then multiplication from the single plant have given better results than artificial cross fertilization or frequent importation of seed from America.

The continuance of Government seed farms is a necessary adjunct to a native cotton industry, and only by continual selection and annual distribution of seed can the cotton in Nyasaland be maintained at its present satisfactory quality.

THE COST OF LABOUR AS AFFECTING THE COTTON CROP (ESPECIALLY IN THE UNITED STATES).

By Professor John A. Todd, B.L.,

University College, Nottingham.

[Abstract.]

As an economist, the writer's chief interest has always been in the economic side of the cotton trade, with special reference to the cost of production, the recent rise of prices due to the enormous increase of the world's consumption, and the prospects of increase of the world's supplies.

The possibilities of increase are limited in different countries by different conditions. In Egypt, for example, the limiting factor is largely area, and the possibilities of increased irrigation, for the area available is entirely dependent on the water

supply. In other countries, especially East and West Africa, the cost of transport is almost the most important item. In these as in many other areas, however, the labour supply is the easiest factor in the problem. In the Sudan, again, the labour problem is one of considerable difficulty, as the labour supply was depleted by war, etc., and will take a long time to recover.

In the United States, on the other hand, the cost of labour, and the sheer impossibility of obtaining sufficient labour, is hampering the development of the possible area in an extraordinary way, especially in certain parts of the Cotton Belt, such as Texas. The result is that the cost of production of the crop has increased so greatly in recent years that it is doubtful whether even the high range of prices which has become almost normal now is sufficient to make the crop really profitable, or at least sufficiently so to tempt a great increase of area. To take only one point, the actual cost of merely picking the crop from the plants is now about 2 cents per lb., while the price of the crop is only about 12 cents. In the new irrigated tracts in Arizona and California where Egyptian cotton has been successfully grown, the cost of picking is still higher, even in proportion to the high price obtained for these superior cottons. It seems, therefore, that labour cost bids fair to become the limiting factor in the development of the American cotton area.

Cotton has always been regarded as essentially a cheap-labour crop. This was one of the chief arguments of the South against the abolition of slavery. Now labour in the South is no longer cheap, and it is doubtful whether the cultivation of the ordinary grades of cotton can withstand the increased labour cost.

There seems little hope of the immediate invention of any mechanical appliances, such as pickers, which would help to solve the problem. The only other alternative is an improvement of the type of cotton grown, so that the value of the crop may bear a more reasonable proportion to its labour cost.

In this problem America seems to be approaching the position of many other possible areas for cotton growing throughout the world, where the impossibility of obtaining a sufficient and cheap labour supply absolutely rules cotton growing out. This is, for example, the case in Argentina, where cotton could quite well be grown if labour were available.

The problem is one of great importance to those other tropical countries where the labour supply is abundant and cheap and the conditions are otherwise suitable for cotton growing, especially India, East and West Africa, and China.

ESTIMATED COST OF PRODUCTION OF COTTON IN TEXAS IN 1913.

Farm of 100 acres, held under crop-sharing lease, landlord taking one-fourth of cotton lint and seed. Yield taken as 200 lb. lint and 400 lb. seed per acre.

Tenant's Capital:—		
Horses, mules, harness, implements, waggons, and miscellaneous plant, $1,478.55. Interest thereon at 10 per cent. and depreciation at 12½ per cent.		$332.67
Seed:—		
75 bushels at $2.00		150.00
Labour:—		
2 hands for 6 months at $20 each ...	$240.00	
Chopping cotton twice	150.00	
Picking 40 bales at average 85 cents per 100 lb. of seed-cotton	510.00	
Weighing cotton at 75 cents per bale ...	30.00	
Hauling cotton to ginnery 24 days at $2	48.00	
		978.00
Ginning and Baling:—		
Weighing at ginnery 10 cents per bale ...	4.00	
Ginning, baling, and wrapping at $3 per bale	120.00	
		124.00
Stock Feed:—		
450 bushels corn at 50 cents	225.00	
365 bales hay at 50 cents	182.50	
		407.50
Supervision, estimating the wages of a manager for 1,000 acres at $100 per month		120.00
		$2,112.17
Value of Crop:—		
40 bales cotton at, say, 12 cents per lb. ...	$2,400	
40,000 lb. seed at $20 per ton	400	
	2,800	
Less one-fourth share to landlord ...	700	
		$2,100.00

COMMERCE AND SCIENCE IN COTTON GROWING.

By J. W. McConnel,

Vice-Chairman of the Fine Cotton Spinners' and Doublers' Association.

[Abstract.]

The object of the paper is to suggest the proper objective of cotton growers and breeders.

Success in cotton growing can only be obtained by the application of scientific principles. In America cotton growing is contemporaneous with cotton spinning, and spinners have adapted themselves to American cotton. But in India want of science in the past has wrought great evil. In Egypt some attention to scientific principles has brought some measure of success. In all new countries science is essential to cotton.

No natural cotton is good. All goodness is added by human agencies.

What is good in cotton? This is difficult for either grower or spinner to answer. But it is becoming possible in the present day of scientific study in Agricultural Departments and Technological Institutions. In America practical mill experiments have been made with cottons as classified under the new Official Standards. *Bulletin* No. 62, *U.S. Dept. Agric.* mentions that only the qualities of colour and freedom from waste are so far considered. It is recognized that length, strength, clinging qualities, and bleaching qualities are also important. These may be accepted with the addition of fineness. But there is room for research work as to the relation between length, strength, adhesiveness, and fineness in cotton, and fineness, strength, and regularity in yarn.

Cheapness is also necessary for grower and for spinner. Proper cultivation is necessary, but above all the evolution of a prolific strain. Quality and quantity are not incompatible.

Questions for consideration by countries desiring to grow cotton are stated. For countries already growing cotton the two questions are: How can the cotton be so improved as to be worth more money?—and How can it be made more prolific so as to cost less to produce? The author in this paper has attempted to show where the answer is to be found.

Uniformity, in addition to all other qualities, is essential. Uniformity comes from purity of strain. Reference is made to Mr. Lawrence Balls's work. Purity itself gives value to cotton. This is believed by good practical cotton growers.

It is evidenced by American experiments with Egyptian cottons in Arizona, and by the very successful mill tests of Mr. Balls's four pure strains, of which details are given.

Purity of strain should be the principal objective of all cotton growers.

It is suggested in the paper that arrangements ought to be made either at the Imperial Institute or in Manchester, perhaps preferably in Manchester, so that small quantities of cotton can be practically tested under conditions resembling those of an ordinary mill. In experienced hands a trustworthy test can be made with a pound weight of cotton or even less. If some such practical testing were regularly available it would greatly assist the scientific breeders and laboratory workers in cotton-growing countries, because they would not only be able to send small samples to be submitted to the test, but they would also be enabled to bring their laboratory experiments on single bolls and single fibres into closer relation with mill practice than is now possible.

[Discussion.]

The Chairman: Will any gentleman make any observations on the papers which have been read?

M. E. Leplae (Director-General of Agriculture, Colonial Office, Belgium): My Lord—I have listened with much interest to the details given by Mr. McCall regarding his cotton-selecting experiments in Nyasaland. I understand that the Nyasaland cotton is really an American Upland cotton, and it seems that the cotton grown in Uganda is an American Upland cotton also—the Black Rattler, if I am right. Now we have been reading all that has been published on introducing cotton into Central Africa, and I would like to ask Mr. McCall if I am right in coming to this conclusion—that no other cotton than American Upland cotton has ever been a success in Central African Colonies. I believe that until now only American cotton has been successfully grown in Central African Colonies, and it would be very useful for us to know if that is correct. (Mr. McCall: That is the case.) We are now trying cotton in the Congo under an American expert; he is doing very good work there, but it will be useful to know in what direction we shall have to work.

Mr. J. Percival: My Lord and Gentlemen—I should like to emphasize some of the remarks which Mr. McCall has made in his very valuable paper to-day. I have been closely associated with him in the selection experiments which he has been carrying out in Nyasaland, and I must say the success

which he has achieved is really remarkable. The cotton he originally took had no type or character connected with it at all, but now in going through the fields which have resulted from the seed produced by Mr. McCall, you can see that each plant is of a distinct type, and that the bolls do not have the haphazard shapes they used to have, but all have one peculiar shape. These facts indicate that there is great benefit in the selection begun by Mr. McCall in Nyasaland. In connection with the British Cotton Growing Association, we handle most of the cotton Mr. McCall has been producing in his experiments, and most of the samples sent home for examination show that much can be done in the way of improving cotton by selection experiments as carried out by Mr. McCall. I am sure that if such a system were carried out more generally, not only by Departments of Agriculture, but by individual planters, very much could be done towards making cotton a success where it is not a success at present. Much, of course, depends upon climate, insect pests, soils, and various other things over which the planter thinks that he has no sort of control; but if he were to carry out this system for a series of years, I am sure that much practical value would result from it.

The Chairman: Gentlemen—I regret that I have not been able to be present during the reading and discussion of the various important papers that have been communicated to this Congress. I need hardly say that all matters connected with the improvement of cotton production, and especially Egyptian cotton, are of very real interest to me, and it gives me great satisfaction to have arrived here in time to preside while reference has been made, in one of the papers we have just heard read, to the problems connected with the progress of cotton cultivation in the valley of the Nile, with which I have been so closely associated during the past few years.

I think we may claim that both as regards relative yield and quality Egypt has maintained the premier position for many years amongst cotton-producing countries. Since 1821, when this cultivation was commenced by the first Khedive in Egypt, it is a very interesting study to follow the evolution of the different characteristic types of cotton which have proved to be specially adapted to the climatic and soil conditions of the valley and delta of the Nile. Unfortunately, deterioration invariably sets in after a certain period of years, and scientific research has to be continuously employed with a view to recreating those types of cotton that have given the name and fame to Egyptian cotton which it so rightly bears.

The successful development of an agricultural product such

as Egyptian cotton on a proportionately large scale demands constant care, and the new Ministry of Agriculture fully realizes the importance and responsibility of the task it has in hand, not only as regards Egypt but also to all those large manufacturing centres that use Egyptian cotton. The successful development of this industry in Egypt depends on most serious attention being paid to the following points: (1) The renewal, by purer strains, of the cotton seed in the country, which is liable to deterioration every seven years; (2) the regulation and improvement of irrigation and drainage; (3) the proper cultivation and manuring of the land and the rotation of crops; and (4) an incessant war that has to be waged against insect pests.

In a country like Egypt, scientific agricultural methods must, in order to be acceptable to the fellaheen, be suggested in simple form for assimilation by them. It is gratifying to note that the means at present adopted are having the desired effect. Prejudice and apathy in these matters are gradually being replaced by a more intelligent interest in the benefits attached to the observance of scientific principles. It may, I think, be of interest to some gentlemen present if I mention an example of what can be done by treating Egyptian soil in a scientific manner, and how the value of such methods may be brought home to the fellaheen by practical demonstration. Towards the end of 1912, about 800 acres of absolutely waste land at Biala were taken in hand. The land was so heavily impregnated with salt that for ages nothing had grown upon it. Before the experiment began, the distribution and percentage of salt were carefully measured all over the area, and are shown on the diagram. A scientific system of irrigation and drainage was laid out on the land, at a cost of £10 an acre, and it was then handed over to the fellaheen in five-acre plots for cultivation. They had to clean and level their plots, which were made over to them on a special tenure, practically becoming their property after repayment of all expenditure and a very small rent. Last year the land was washed and a crop of rice was grown, giving a satisfactory yield. After the rice crop, the salt distribution was again taken, by the same system of measurement as before the work has begun, with the result shown in the next diagram. In this case, to the great astonishment of the fellaheen cultivators, a permanent result has been achieved in one year, which under the ordinary system prevailing in the country would have taken three to four years to accomplish, and even then, with inadequate drainage, the land would have been liable to go back to its original state. It would no doubt have been better to have

continued the washing and grown another rice crop this year, but owing to the shortage of water throughout the country, it was impossible to allow this to be done. Cotton is now therefore being satisfactorily grown on a fair proportion of this area, and it is hoped will bring in from £15 to £20 an acre. When we consider that there are about 1,500,000 acres of equally waste salt land in the delta waiting for development by drainage, the value of this experiment can, I think, be appreciated.

The opening up of a new field for the production of Egyptian cotton in the Sudan is a matter of the highest importance. The results of experiments in growing cotton on the Gezira plain have proved that a fair yield of good quality Egyptian cotton can be produced there at a time of year when there is no special demand for water in Egypt; for the harvesting of cotton in the Sudan synchronizes with the sowing of cotton in Egypt. Thus a great future is in store for the Sudan as soon as the irrigation works on the Blue Nile now being undertaken are completed, enabling the vast area available for cotton cultivation to be fully developed.

The advantages which accrue from an International Congress such as this consist in the bringing together of the ideas of agriculturists and scientists from all parts of the world for the benefit of each other, and judging by the principle that two heads are better than one, the results obtained from this association should be of the greatest utility.

Before closing this meeting, I wish to offer my best thanks to Professor Dunstan, who has been good enough to fill the chair during my unavoidable absence.

The President: Gentlemen—I should like first of all to suggest that you should accord a hearty vote of thanks to the readers of the papers this morning, all of which have been important and interesting. I regret, however, that we have not been able to give sufficient time for their full discussion. We are very sensible of Lord Kitchener's kindness in coming here to preside at this meeting and in reading a paper illustrated by diagrams. That paper, which was a surprise, is one which has a special interest of its own, and I fancy that Lord Kitchener wishes to press home a fact to which I have always attached importance, namely, that the results of scientific work in tropical colonies, including cotton cultivation, require to be brought home to the native growers by practical demonstrations. As you are aware, we are a Congress consisting not only of scientific experts, but also of users of materials grown by the tropical agriculturist, and there is no doubt that is a most important point for all of us to realize. I believe

one may go so far as to say that there is a large amount of important scientific work being done, the importance of which is not realized, if indeed it is not actually wasted, because it is not followed up by practical demonstrations on a large scale. I therefore propose that you should give a very hearty vote of thanks to Lord Kitchener for coming here this morning and making such an interesting contribution to our discussion.

The Chairman: I am very much obliged to you all for your kind vote of thanks.

MONDAY, JUNE 29.—AFTERNOON SESSION,

2.30 P.M.

Section V.—Cotton.

Chairman: PROFESSOR DR. O. WARBURG, *Kolonial-Wirtschaftliches Komitee, Berlin; Vice-President of the Congress.*

THE CHAIRMAN: Gentlemen—We have now to continue the papers on cotton. I regret to say that Herr Moritz Schanz, who intended to read a paper on cotton cultivation in the German Colonies, is not here. He has sent his paper, but it is rather long, and in the German language, and so I shall only give a summary of it. It is a general review of the cultivation of cotton in the German Colonies during the last few years.

BAUMWOLLBAU IN DEUTSCHEN KOLONIEN.

Von MORITZ SCHANZ, Chemnitz.

[ABSTRACT.]

Die Entwicklung der Exportkultur von Baumwolle in den drei deutsch-afrikanischen Kolonien, Togo, Kamerun und Ostafrika hat seit dem Jahre 1910 stetige Fortschritte gemacht.

In *Togo* hat man, da das Land überwiegend im Besitz der Eingeborenen ist, auch die Baumwollkultur von vornherein als Klein oder Volkskultur und nicht als Plantagenkultur unter Leitung europäischer Besitzer betrieben und die Ernte ist von 40 Ballen à 250 kg im Jahre 1901 auf 2,200 Ballen im Jahre 1912 gestiegen. Es handelt sich dabei in erster Linie um eine einheimische Sorte sogenannter "Togo Sea Island" Baumwolle, die einer guten amerikanischen "Upland middling" entspricht. Der Baumwollexport Togos ist noch steigerungsfähig, scheint aber kaum je eine besondere Ausdehnung nehmen zu können.

With the Organising Secretaries' Compliments.

We regret very much that you will not be able to be present at the Congress.

The Third International Congress
of Tropical Agriculture,
Imperial Institute,
London, S.W.

Recht aussichtsreich liegen dagegen die Vorbedingungen für weite Teile von

Kamerun, sobald erst einmal das Innere durch Eisenbahnen erschlossen sein wird. In dem dortigen Grasland wächst Baumwolle nicht nur vielfach wild, sondern wird von den Eingeborenen, vorläufig nur für ihren eigenen Gebrauch, auch in grossem Umfang angepflanzt. Es steht hier eine dichte und intelligente, ackerbautreibende Bevölkerung zur Verfügung und die Regierung hat in diesen Distrikten bereits zwei landwirtschaftliche Versuchsstationen eingerichtet, welche die geeignetsten Baumwollsorten herausfinden und züchten, die Eingeborenen zur Baumwoll-Exportkultur erziehen und weisse und farbige Wanderlehrer heranbilden sollen, damit die Ausdehnung der Kultur auf sicherer Basis erfolgen kann, sobald verbesserte Transportmöglichkeiten sie lohnend machen.

Die grössten Hoffnungen betreffs kolonialen Baumwollbaues setzt man in Deutschland aber auf

Deutsch-Ostafrika, wo man zunächst ägyptische Sorten begünstigte, seit einigen Jahren aber überwiegend die widerstandsfähigeren Upland-Sorten anbaut, die sich in Uganda und in Nyasaland bewährt haben. Die Gesamtausfuhr Deutsch-Ostafrikas an Baumwolle betrug im Jahre 1912: 7,526 Ballen à 250 kg.

Leider besitzt Deutsch-Ostafrika keine grosse einheitliche Baumwollzone, sondern nur eine Anzahl kleinerer Baumwollgebiete von sehr verschiedenem Charakter, so dass überall besondere Studien notwendig sind. Als grösstes Hindernis erwies sich vielerorts die Unsicherheit der meteorologischen Niederschläge, und zwar handelt es sich teils um Regenmangel, teils um Regen zur unrechten Zeit.

Da in Ostafrika für Baumwollbau geeignete Ländereien zu billigen Bedingungen dem Europäer kauf- oder pacht-weise zur Verfügung stehen, so hat man hier sowohl Plantagen, wie auch Volkskultur eingeführt, dabei allerdings vielerorts noch unter allerlei Baumwollschädlingen und Krankheiten, besonders unter der verhängnisvollen Kräuselkrankheit zu leiden.

Es ist zu hoffen, dass die von der Regierung innerhalb der letzten Jahre geschaffene vorzügliche Organisation des Baumwollversuchswesens in den Kolonien auch in der Bekämpfung dieser Hindernisse erfolgreich wirke.

Die gemeinnützigen Bestrebungen des Kolonial-Wirtschaftlichen Komitees zur Hebung des Baumwollbaues in deutschen Kolonien erstrecken sich besonders auf unentgeltliche Lieferung guter Saat für Eingeborene,[1] Garantieleistung von

[1] Von der Campagne 1914-15 ab wird das Kaiserliche Gouvernement die Lieferung von Saat für Eingeborene selbst übernehmen.

Minimalpreisen der erzeugten Baumwolle für die Eingeborenen, sowie auf die technischen Fragen.

Innerhalb der Jahre 1900 bis 1913 sind vom Kolonial-Wirtschaftlichen Komitee und von der Regierung zusammen rund 4 Millionen Mark zur Förderung des deutsch-kolonialen Baumwollbaues ausgegeben worden und man darf nach Ueberwindung der Anfangsschwierigkeiten in dem spröden tropischen Afrika, wo es an jeglichen Vorbildern und Erfahrungen fehlte, eine günstige Entwicklung erhoffen.

[Translation.]

COTTON CULTIVATION IN THE GERMAN COLONIES.

The development of cotton cultivation for export in the three German-African colonies of Togo, Cameroons, and East Africa has been making steady progress since the year 1910.

In *Togo*, as the land is mainly owned by the natives, cotton cultivation has from the outset been carried on in the shape of petty or peasant cultivation, and not on a plantation scale under the management of European proprietors, and the crop has increased from 40 bales of 250 kilograms in the year 1901 to 2,200 bales in the year 1912. The main product is a native variety known under the name of "Togo Sea Island" cotton, which corresponds to a good American "Upland Middling." The cotton exportation of Togo is capable of further increase, but scarcely appears likely ever to be very extensive.

Large portions of the *Cameroons* appear to possess the primary conditions for prospective development, when once the interior has been opened up by railways. Not only does cotton commonly grow wild in the grass lands there, but it is also cultivated on a large scale by the natives, although only for their own use. A dense and intelligent agricultural population is available here, and the Government has already established two agricultural experimental stations in these districts for the purpose of discovering and raising the most suitable varieties of cotton, instructing the natives in the cultivation of cotton for export, and training white and native travelling instructors in order that the extension of cultivation may take place on a secure basis as soon as improved facilities of transport make it remunerative.

In Germany, however, the greatest hopes in respect of Colonial cotton cultivation are set upon *German East Africa*, where in the first instance Egyptian varieties were favoured, but for some years past the Upland varieties, which are more capable of resistance and which have proved satisfactory in

Uganda and Nyasaland, have been cultivated. The total exportation of cotton from German East Africa in the year 1912 amounted to 7,526 bales of 250 kilograms.

Unfortunately German East Africa does not possess any extensive compact cotton district, but only a number of small cotton areas of very varying character, so that special investigations are necessary in each instance. The great hindrance that manifested itself in many places was the uncertainty of the rainfall, and this was partly a question of shortage of rain and partly of rain coming at the wrong season.

As lands suitable for cotton cultivation were available in German East Africa for Europeans to purchase or rent, both plantation and peasant cultivation have been introduced, but in many cases cotton-plant pests and diseases, especially the fatal "curl" disease, have been experienced.

It is to be hoped that the excellent organization of the cotton experimental service in the Colonies created by the Government within the last few years may be successful in combating these obstacles.

The public-spirited efforts of the German Colonial Economic Committee for improving cotton cultivation in German Colonies particularly include the gratuitous supply of good seed to natives,[1] the guarantee of minimum prices to natives for the cotton produced, as well as technical investigations.

During the years 1900 to 1913 the Colonial Economic Committee and the Government have jointly expended a sum of about 4 million marks in the advancement of German Colonial cotton cultivation, and after conquering the initial difficulties in repellent tropical Africa, where there were no examples to follow or experience to guide, favourable developments may be anticipated.

[Discussion.]

Mr. T. Thornton (Nigeria): Mr. Chairman—I should like to ask if you can give us any idea of the return per acre in these different parts of the German Colonies. It is very interesting to listen to a paper on the development of cotton cultivation in the German Colonies, and we who are working on cotton in other countries would like to have an idea as to the returns which are obtained. I am working in Northern Nigeria, and it is possible that the conditions there are, to a certain extent, similar to the conditions under which cotton is being grown in the places you have mentioned. I should therefore like to

[1] Starting from the 1914-15 campaign, the supply of seed to natives will be undertaken by the Imperial Government itself.

know if you can give us the returns per acre which are obtained in the German Colonies.

The Chairman: I cannot give any detailed figures; I can only say that the yield varies considerably in different parts. Togo, which is nearest to Northern Nigeria, and where the conditions may be somewhat similar, has only native cultivation of cotton, and the natives do not grow cotton by itself, but always between other products, chiefly yams. In the Cameroons we have no real cotton cultivation at present as the natives only grow very small patches for their own use; the Government farms were only founded last year, and I cannot give any details regarding them. In East Africa we must make a distinction between the cultivation of cotton by planters and its cultivation by natives. Some of the planters grow cotton between other plants, for example, Sisal hemp, but it has not proved advantageous, and they are abandoning this sort of cultivation. There are other planters, however, who grow cotton alone, and some even with irrigation; but the yield obtained by these planters varies very much from one year to another. In a good year, they get as much as generally in America—one bale of 500 lb. per hectare, that is 200 lb. of lint per acre; generally it is less. We do not know yet if it will really pay them. Some got good results last year, but only because this Egyptian cotton pays very well. The question depends always on the possibility of getting good crops from the Egyptian cotton. Among the natives in East Africa the return also varies very much. There are some districts, open districts near the Victoria Nyanza, which are very good; other parts, however, are only just beginning, and at present it is not possible to make any general statement as to the yield.

PROBLEMS CONNECTED WITH THE NEW EGYPTIAN COTTON PEST, *GELECHIA GOSSYPIELLA*, SAUNDERS, THE PINK BOLL-WORM.

By L. H. Gough, Ph.D., F.E.S.,

Chief, Entomological Section, Ministry of Agriculture, Egypt.

[Abstract.]

Gelechia gossypiella, Saunders, a microlepidopterous insect, the larva of which infests cotton seed and immature cotton bolls, was introduced into Egypt with badly ginned cotton from India, between the years 1904 and 1909, and has become established as a pest on cotton. Popular opinions vary as to the extent of damage done by or expected from this insect.

In Egypt *Gelechia gossypiella*, Saunders, can have several generations each year; some individuals, however, require much longer to develop than others, and thus the number of generations varies from one brood to about six. The longer broods have a hibernation or æstivation period as larvæ, when full grown after finishing feeding and before pupation. This period may last only one week, or be protracted indefinitely with the larvæ subjected to the same conditions.

The pink boll-worm is attacked by the following parasites: *Pimpla roborator, Chelonella sulcata, Limnerium interruptum, Pediculoides ventricosus, Microsporidium polyedricum.* These parasites can cause damage up to 40 per cent., or perhaps even more, to hibernating larvæ. The effect of the control exercised by the parasites is already noted in the field; wherever records are available the attack by *Gelechia* has been worst in the second year, being much reduced in the third.

The amount of damage done is very difficult to estimate. In the cotton-growing season of 1913 *Gelechia* larvæ did the greatest amount of damage hitherto recorded for them in Egypt, yet in spite of this the exportation of cotton lint reached record figures. Of course the quality may have deteriorated. Damage to seed is more obvious, about 10 per cent. on the average having been damaged and made infertile, thus reducing the germination of average seed from 85 to 75 per cent. From the point of view of sowing, this makes no great difference, as the Egyptian cultivators invariably sow from eight to twelve seeds in a hole, and later on eliminate all but two of the seedlings.

The only remedies available against this pest are the destruction, during the winter, of all bolls on cotton sticks stored for fuel, and the fumigation or other treatment of the cotton seed in the ginneries. The first of these two requirements has been made the subject of proposed legislation, and it is hoped that the second will be voluntarily done by the ginners, as we have shown the possibility of complete destruction of all larvæ in cotton seed by fumigation in circulating carbon disulphide vapours, or in circulating hydrocyanic acid or sulphur dioxide gas, as well as by suitable treatment with hot air or by immersion in weak solutions of cyllin.

[Discussion.]

The Chairman: I think you will all wish to thank Dr. Gough for his interesting paper, which illustrates very well the dangers which all countries have to face so long as there are no international laws for regulating the importation of seeds, plants, etc. It is a question which we discussed here the other day.

Mr. E. E. Green: Mr. Chairman—Dr. Gough's paper has interested me very much, because I had some interesting experiences in Ceylon in connection with the very limited cotton cultivation that has been carried on there. I should like to ask him whether he does not think that the *Gelechia gossypiella* might possibly have been already present in Egypt on some of the other plants which have been grown there for a great number of years.

Dr. Gough: I think it must have been introduced within the last ten years. There are a number of enthusiastic entomologists in Egypt, and quite a number of old collections, and I think that had the insect been in the country it must have been found. At all events it has only become common in the last few years, and there seems to be no evidence that any of the insects had been taken prior to 1910 in Egypt.

Mr. Green: Did I understand you to say that carbon disulphide had no effect on the larvæ unless the vapour was circulated through the seed? Carbon disulphide is usually considered such a very useful remedy, and, the vapour being heavier than air, it is supposed to be sufficient to put the liquid in an open vessel on the surface of the seed to be treated.

Dr. Gough: That is quite contrary to our experience. As soon as we circulated the carbon disulphide vapour there was no difficulty in killing off the larvæ. The circulation of the vapour was maintained by means of an air pump.

Mr. J. W. McConnel: At what time in the year do you see these insects in the growing crop?

Dr. Gough: The first moths come to life about July; after that we take moths continually till January.

LES SELS NUISIBLES ET LE COTONNIER EN EGYPTE.

Par Victor M. Mosseri,
Membre de l'Institut Egyptien.

[Abstract.]

De ce que le cotonnier végète, dans la partie septentrionale de l'Egypte, sur des terres qui renferment des doses assez élevées de sels nuisibles dans les soixante ou quatre-vingt-dix premiers centimètres de profondeur, on en conclut d'ordinaire que cette plante manifeste à l'égard des dits sels une grande résistance. On est allé jusqu'à admettre, que la présence dans le sol de 1 à 1·5 pour cent de chlorure de sodium, n'avait aucun effet defavorable sur le cotonnier, tant au point de vue de sa végétation que de son rendement.

Ayant depuis longtemps reconnu l'erreur d'une telle opinion

nous avons institué, dès 1907, une série de recherches, en vue d'étudier le cotonnier dans ses relations avec les divers sels que l'on trouve dans les terres d'Egypte.

Ces recherches ont toutes été effectuées sur des cultures en plein champ, ne s'écartant point des conditions normales. Elles ont été multipliées de façon à éliminer autant que possible l'influence des facteurs étrangers.

On s'est d'abord attaché à établir la dose moyenne de sels et la nature de ces derniers, compatibles avec tel ou tel rendement et cela dans un assez grand nombre de localités qui diffèrent entre elles au point de vue du sol, du climat, etc., etc.

On a cherché ensuite la raison de certaines différences constatées entre le Nord du Delta et les autres parties du pays.

Dans une autre série d'études, on a essayé de préciser de quelle façon se traduit sur la végétation de la plante et sur ses produits, l'action des sels.

Toutes ces recherches n'ont pas seulement un intérêt spéculatif. Les données qui en découlent sont très précieuses dans un pays comme l'Egypte où la question des sels nuisibles est d'importance capitale au point de vue de la fertilité du sol.

Ces données trouvent leur application directe dans la mise en valeur des Bararis.

Elles nous ont servi à découvrir la cause de la stérilité plus ou moins complète de certaines terres et nous ont conduit ainsi au traitement rationnel à leur appliquer.

Enfin, ces données nous ont souvent fourni l'explication de certaines anomalies observées dans beaucoup d'essais de fumures.

[Translation.]

INJURIOUS SALTS AND THE COTTON PLANT IN EGYPT.

From the fact that the cotton plant grows in the northern part of Egypt in soil which contains fairly large quantities of injurious salts in the topmost sixty or ninety centimetres, it is usually assumed that this plant offers great resistance to such salts. It has even been admitted that the presence in the soil of 1 to 1·5 per cent. of sodium chloride has no unfavourable effect upon the cotton plant, either from the point of view of its growth or of its yield.

Having long recognized the error of such an opinion, we have carried out since 1907 a series of investigations with the object of studying the cotton plant in its relations with the various salts found in Egyptian soils.

These investigations have all been effected on cotton cultivated in the open field, in no way removed from normal

conditions. They have been repeated so as to eliminate as far as possible the influence of outside factors.

The first thing attempted was to settle the average quantity of salts and their nature, compatible with such and such a yield, and that in a sufficiently large number of localities differing amongst themselves as to soil, climate, etc., etc.

Next the causes for certain differences ascertained to exist between the north of the Delta and other parts of the country were investigated.

In another set of investigations an attempt was made to ascertain exactly how the action of the salts affects the growth of the plant and its products.

These researches are not merely of academic interest. The deductions derived from them are very valuable in a country like Egypt, where the question of injurious salts is of supreme importance from the point of view of the fertility of the soil.

These data find a direct application in the development of the Bararis.

They have enabled us to discover the reason of the more or less complete barrenness of certain districts, and have thus led us to a rational method of treatment for such areas.

Lastly, these results have frequently afforded an explanation of certain anomalies observed in many manurial trials.

The Chairman: Je remercie M. Mosseri pour sa contribution très importante et nous sommes sûrs qu'elle servira beaucoup à mettre en valeur les régions larges et vastes en Egypte, auxquelles Lord Kitchener a référé ce matin.

[*Translation.*]—I thank M. Mosseri for his very important contribution and we are sure that it will greatly help in developing the wide and vast regions in Egypt to which Lord Kitchener referred this morning.

CULTURE, SANS IRRIGATION, DU COTON AU TURKESTAN RUSSE.

Par Boris de Fedtschenko,

Principal Botanist, Imperial Botanic Garden of Peter the Great. St. Petersburg.

[No abstract supplied by the author.]

The Chairman: We are much obliged to M. Fedtschenko for his interesting contribution which deals with a question of considerable importance for vast regions in other parts of the world, chiefly Turkey. In Asia Minor, also, cotton is grown without irrigation, and in places which have a rather

dry climate. Generally the varieties of cotton grown in these dry localities have a very short fibre, and it may be possible to obtain a better result chiefly by selection, but also by the introduction of new varieties. I hope this question will be taken up later on by the different nations which are chiefly interested. and I am very glad to hear that the Russians, who have large territories where these climatic conditions obtain, are now devoting attention to this very important work.

LA CULTURE EXPERIMENTALE DU COTON EGYPTIEN EN GRECE.

Par C. Phoca Cosmetato.

[Abstract.]

Depuis quelques années le Gouvernement Hellénique a fait de grands efforts pour favoriser en Grèce la culture experimentale du coton Egyptien, tant parmi les différentes stations agronomiques, que parmi les Sociétés d'Agriculture, et les particuliers.

Etant donné le climat doux de la partie du royaume qui est limité par la frontière qu'avait la Grèce avant la guerre, cette culture est appelée à prendre une grande extension dans cette région.

L'hiver étant très doux et relativement de courte durée, nous pouvons executer nos semailles de bonne heure, vers le commencement du mois mars, ce qui a une très grande importance pour la bonne réussite et le bon rendement de notre entreprise.

D'autre part, le mauvais temps et les pluies n'étant pas à craindre pendant la maturation du fruit, nous pouvons obtenir une parfaite maturation de celui-ci, aussi qu'un rendement élevé.

L'expérimentation de cette culture a été faite un peu partout dans le royaume, aussi bien au Peloponèse, que sur la Grèce Continentale.

La Société d'Agriculture de Githion, après avoir expérimenté pendant plusieurs années la culture du coton, se déclare très satisfaite des résultats obtenus jusqu'aujourd'hui. Comme condition essentielle du succès, elle attire l'attention du Service Agricole, sur la nécessité qu'il y a à faire les semailles de bonne heure après une bonne préparation du terrain, vers le commencement du mois de mars et pas plus tard que les derniers jours de ce même mois.

La culture du coton a été faite sur du terrain non irriguable,

et en général le rendement sur les terres de richesse moyenne, et se desséchant relativement en été, a été de 1·00 à 1·025 kilo de coton par hectare, et de 1·150 à 1·300 kilo par hectare, pour les terres riches, et conservant en été une assez grande humidité.

La Station Agronomique de Messolonghi a experimentée, sur une assez grande surface irriguable, la culture du coton avec la variété Sakellaridis. Malgré l'époque retardée à laquelle on a fait les semailles, vers le commencement du mois d'Avril, et malgré les chaleurs d'été qui en ont suivies, le thermomètre ayant atteint 39 et 40° C., le rendement a été encore renumerateur, puisqu'il a atteint 900 kilos de coton par hectare.

Le Gouvernement Hellénique soucieux de savoir exactement quelle était la valeur du coton récoltée sur les différentes régions du royaume, tant au point de vue de sa qualité, qu'au point de vue de sa valeur marchande, a envoyé des échantillons en Egypte à la maison bien connue de Messrs. Coremi et Benachi, avec la prière de déterminer la qualité à laquelle il fallait classer chaque échantillon, ainsi que sa valeur marchande.

La réponse de la maison de Messrs. Coremi et Benachi a été tout à fait satisfaisante. Après avoir examinée attentivement les différents échantillons, elle a declarée que le coton provenant de Githion était de toute première qualité, et elle a proposée d'acheter tout le coton produit dans ce district au prix de 22 écus le cantare.

Le coton produit a Messolonghi a été trouvé également de bonné qualité, et estimé à 21 ècus le cantare.

Comme les résultats obtenus jusqu'aujourd'hui sont fort encourageant pour cette nouvelle culture, cette année on a fait des expériences sur une plus grande échelle, et on espère que quand dans quelques années la période expérimentale sera définitivement close, on pourra produire en Grèce suffisamment du coton non seulement pour la consommation local, mais aussi pour en exporter.

[Translation.]

THE EXPERIMENTAL CULTIVATION OF EGYPTIAN COTTON IN GREECE.

For some years the Greek Government has made great efforts to encourage the experimental cultivation of Egyptian cotton in Greece at the various agricultural stations as well as by the agricultural societies and private individuals.

Favoured by the mild climate of that part of the kingdom bounded by the frontier which Greece had before the war, this cultivation is bound to extend largely in this region.

The winter being very mild and of comparatively short duration, sowing can be carried out early, towards the beginning of the month of March, a matter of great importance if the enterprise is to succeed and to yield a good return. On the other hand, with no fear of bad weather and rains during the ripening of the fruit, perfect ripening and a high yield can be obtained.

Experiments in this cultivation have been made almost everywhere in the kingdom, in the Peloponesus as well as in continental Greece.

The Agricultural Society of Githion, after having experimented for several years in cotton cultivation, declares itself very satisfied with the results so far obtained. As an essential to success it draws the attention of the Agricultural Service to the necessity of early sowing and a good preparation of the soil, towards the beginning of the month of March and not later than the last days of that month.

Cotton cultivation has been carried out on land not irrigated, and in general, the yield on soil of average richness and relatively dry in summer has been from 1·00 to 1·025 kilograms of cotton per hectare, and from 1·150 to 1·300 kilograms per hectare for rich land retaining a fairly high degree of moisture in summer.

The agricultural station at Messolonghi has made experiments, on a fairly large irrigated tract, in the cultivation of cotton with the Sakellaridis variety. Notwithstanding the late period at which sowing was carried out, towards the beginning of the month of April, and in spite of the hot summer weather which followed, the thermometer having reached 39 and 40° C., the yield was still remunerative, amounting to 900 kilograms of cotton per hectare. The Greek Government, anxious to know exactly the value of the cotton grown in different parts of the kingdom, from the point of view of both quality and market value, sent samples to Egypt to the well-known firm of Messrs. Coremi & Benachi with the request that each sample might be classified as regards its quality as well as its market value.

The reply of the firm of Messrs. Coremi & Benachi was entirely satisfactory. After having carefully examined the different samples they pronounced the cotton from Githion to be of the best quality, and they offered to buy all the cotton produced in the district at the price of 22 talaris per cantar.

The cotton produced at Messolonghi was also found to be of good quality, and was valued at 21 talaris per cantar.

As the results so far obtained are very encouraging for this

new cultivation, experiments have been made this year on a larger scale and it is hoped that when after a few years the experimental period is definitely concluded, it will be possible to produce in Greece sufficient cotton not only for local consumption but also for export.

The CHAIRMAN: J'ai à remercier M. Cosmetato pour sa contribution très intéressante qui se refère à une question très difficile et peu explorée jusqu'à présent, mais qui deviendra sans doute intéressante pour l'avenir.

[*Translation.*]—I have to thank M. Cosmetato for his very interesting contribution, which refers to a difficult subject and one which has been so far little studied but will undoubtedly become of great interest in the future.

SUR LES OSCILLATIONS DES ATTRIBUTS HEREDITAIRES ET LA RESULTANTE DES EQUILIBRES CONSTATEES SUR LE COTON EGYPTIEN.

Par NICHOLAS PARACHIMONAS.

[No abstract supplied by the author.]

The following papers were taken as read:—

A NOTE ON THE IMPROVEMENT OF COTTON IN BRITISH INDIA.

By G. A. GAMMIE,

Imperial Cotton Specialist, India.

[ABSTRACT.]

During the rule of the East India Company, when the question of extension of cotton cultivation was first considered, the idea of improving the quality of the crop for the benefit of the people themselves was scarcely considered. A supply of superior cotton capable of competing with the product of America was the definite object of many trials which were undertaken from 1788 onwards. The final result of all these trials was that American cotton was introduced into cultivation in the Southern Mahratta country of the Bombay Presidency. where it still exists. The perennial Bourbon established itself over small areas in Madras, and several species of foreign tree cottons occur in small numbers in gardens and temple enclosures throughout India.

On the organization of the present Department of Agriculture in India, an attempt was made to find out what were actually the species of cotton in India, their conditions and possibilities of improvement, if such were considered necessary.

At the same time many foreign varieties were tested; of the latter, it can be definitely said that all the tree cottons failed on extended trials, and of the exotic annual cottons only a few are promising enough to be persevered with. So far as our knowledge has taken us, it appears that American cottons of high quality can be grown successfully in the irrigated tracts of Sind, Punjab, and parts of United Provinces. In the southern parts of the Madras Presidency, Southern Mahratta country, and Northern Guzerat there is a strong possibility that a variety of Upland from Cambodia will supply good cotton.

As regards the indigenous varieties, a precise knowledge of these has brought to light the fact that few varieties exist pure in any part of India, and the most valuable work done by the Department so far has been in the separation and extension of the best varieties in the mixtures. For instance, in the Madras Presidency the Karanganni is now grown free from the inferior admixture of the Uppam; in the Bengal areas the white-flowered cottons, on account of their high yield and hardiness, are ousting the other varieties in the mixtures. In other parts of the country where pure varieties have been found a certain amount of improvement has been effected in the staple and ginning percentage; a certain amount of good has also been effected by the substitution of superior for inferior varieties in some districts.

In conclusion, we learn that the purpose of the older experiments was to benefit primarily the English market. The present intention of the work in progress is to benefit the people of the country, and to provide, if possible, a surplus of higher quality for the use of foreign markets.

THE INTRODUCTION OF AMERICAN COTTON INTO SIND PROVINCE, INDIA.

By G. S. Henderson,

Deputy Director of Agriculture, Sind.

[Abstract.]

The cultivation of cotton in Sind has extended considerably during the last few years, and the annual production is now about 150,000 bales. The Sindhi variety yields a short, coarse, strong cotton of good, bright colour, which realizes about $5\frac{1}{2}$d. per lb. with Middling American at 7·30d. per lb.; the ginning yield is about 33 per cent. The method of cultivation consists in sowing the cotton broadcast after irrigation, and ploughing it in; subsequently, the crop receives no attention except one or two hoeings and occasional irrigation.

In attempting to improve the cotton of Sind, superior Indian varieties were first tried, but were soon discarded in favour of exotic kinds. The Department of Agriculture found that Egyptian cotton succeeded on the Government farms, and afterwards 4,000 acres were planted on the Jamroa Canal. The crop was of good quality, but was difficult to dispose of, as the Bombay mills do not use Egyptian cotton. Egyptian cotton has, moreover, the disadvantages that it requires more careful cultivation than Sindhi and has a long growing period, which practically restricts its growth at present to the Jamrao Canal area.

Some years ago trials were made with American cotton, and it was found that this had the advantages of having a short growing period (thus enabling it to be grown on the common inundation canals), of giving a yield per acre equal to that of the Sindhi cotton, of being hardy and amenable to the method of cultivation employed for the Sindhi variety, and of being more easily marketed than Egyptian cotton. The author during a visit to the cotton-growing regions of the United States selected the "Triumph" variety as being the most suitable for Sind. This plant bears large bolls, matures early, gives good yields, and is well adapted for growth on irrigated lands. After repeated experimental trials at the Government farms, it was decided to grow the variety on a large scale, and, early in 1913, 30 tons of seed were distributed in the Jamrao area and 10 tons in Sukkur and Upper Sind frontier. A syndicate of Bombay millowners was formed to buy, gin, bale, and dispose of the crop derived from this seed. The crop amounted to 511 bales, and was sold in Liverpool at an average price of 1d. per lb. below that of Middling American.

Seed for planting 6,000 acres has been distributed this year (1914), and it is expected that with better ginning the product will be equal in grade to Middling American. A seed farm of 200 acres has been started by the Agricultural Department in order to prevent deterioration of the stock.

NOTE PRELIMINAIRE SUR LES ENGRAIS CHIMIQUES DANS LA CULTURE DU COTONNIER EN EGYPTE.

Par Victor M. Mosseri,
Membre de l'Institut Egyptien.

[Abstract.]

Dans ces quinze dernières années, on a fait en Egypte de nombreuses expériences sur la fumure du cotonnier.

La plupart de ces expériences n'ont porté que sur une seule année de culture. Il est rare aussi qu'on ait pris des pré-

cautions spéciales pour se mettre à l'abri des facteurs étrangers, dont l'influence est parfois plus grande que celle de la fumure employée.

Dans la note que nous présentons au Congrès, nous résumons les principales causes d'erreur provenant des dits facteurs, et donnons une idée des difficultés, que l'on rencontre quand on veut se livrer, dans ce pays, à des expériences d'engrais sur le cotonnier.

Nous décrivons le plan que nous avons adopté à la suite de plusieurs années d'essais, plan qui nous semble diminuer le plus possible les chances d'erreurs provenant des causes précitées.

Nous résumons les résultats obtenus par cette méthode dans deux localités de la Basse Egypte.

Ces résultats comprennent l'influence des divers engrais en usage dans ce pays, sur le rendement, le poids des graines, le rendement à l'égrenage, le "lint-index," etc. . . .

Chemin faisant, on a cherché, s'il y avait une relation quelconque entre les formules employées et la susceptibilité des plantes aux attaques du ver rose *Gelechia gossypiella* dont les ravages ont pris en Egypte des proportions considérables au cours de ces deux dernières années.

Enfin, les cotons provenant des diverses parcelles ont été soumis à un examen minutieux pour rechercher quelle peut-être l'action des engrais employés sur les qualités des fibres.

[TRANSLATION.]

PRELIMINARY NOTES ON CHEMICAL MANURES IN THE CULTIVATION OF THE COTTON PLANT IN EGYPT.

During the last fifteen years numerous experiments have been made in Egypt on the manuring of the cotton plant.

The greater part of these experiments have only been made in a single year of cultivation. It is also rarely that special precautions have been taken to exclude outside factors, the influence of which is sometimes greater than that of the manure employed.

In the note we are presenting to the Congress we summarize the principal sources of error arising from the said factors, and give an idea of the difficulties met with when seeking to carry out manurial experiments on the cotton plant in this country.

We describe the plan we have adopted after several years' trials, a plan which appears to us to diminish, as far as possible, the chances of errors arising from the causes enumerated.

We sum up the results obtained by this method in two localities of Lower Egypt.

These results include the influence of the different manures

employed in this country on the yield, the weight of seeds, the yield on ginning, the "lint-index," etc.

Whilst doing this we have endeavoured to find out if there is any connection between the manure used and the susceptibility of the plants to the attacks of the pink boll-worm, *Gelechia gossypiella*, the ravages of which have attained considerable proportions in Egypt during the last two years.

Finally, cottons derived from the various plots have been subjected to a minute examination to discover what may be the action of the manures used on the qualities of the fibres.

The CHAIRMAN: I think we are now at the end of our proceedings, and I am sure that you will wish to give a vote of thanks to all who have furnished contributions this afternoon. To-morrow morning we shall have the remainder of the cotton papers.

MONDAY, JUNE 29.—AFTERNOON SESSION,

2.30 P.M.

Section VI.—Jute and Hemp.

Chairman: MR. C. C. McLEOD, *Chairman of the London Jute Association.*

THE CHAIRMAN: Gentlemen—The first paper to be read this afternoon is one by Mr. R. S. Finlow, Fibre Expert to the Government of Bengal, on "Jute and its Substitutes."

JUTE AND ITS SUBSTITUTES.

By R. S. FINLOW,

Fibre Expert to the Government of Bengal.

[ABSTRACT.]

Jute has been cultivated in Bengal since very ancient times, but the export of raw jute, which marks the commencement of the great development of the crop, is quite modern. Even as late as the end of the first quarter of the nineteenth century the export of raw jute from India amounted to only a few hundreds of maunds—say 30 tons. Difficulty was experienced at first with jute, as with most other new products, in finding a market for it, but the trade in the raw fibre gradually expanded, the development being greatly aided by the Crimean War, until at the present time jute has practically completely replaced all other fibres as a basis for the manufacture of gunnies. To-day the total produce of jute in Bengal amounts to something like 1,750,000 tons, grown on upwards of 3,000,000 acres.

For its growth jute requires a high temperature and also abundant moisture in the soil. It is, however, contrary to what is generally supposed, not a crop which requires the land

to be submerged during the period of its growth. Very fine jute is grown on lands which never go under water; it is indeed only during the later stages that even the more resistant of the two commonly grown varieties is capable of withstanding heavy flooding without serious damage. It is a rapidly growing crop, commonly sown in April and reaped at the end of July or beginning of August, which may produce 20 tons of green matter per acre in about four months; and it is, therefore, no matter for surprise that cultivation which may be described as intensive gives the best results. Usually cow-dung or castor cake or similar general manures are the fertilizers which produce the best results, but in some tracts the land is acid and the Bengal Agricultural Department has shown that lime is capable of materially increasing the crop. Apart from preparation of the land and sowing of the seed the important operations in connection with the crop are:—

(*a*) Weeding and thinning.

(*b*) Cutting, steeping (*i.e.*, immersion in water), and retting (rotting).

(*c*) Stripping the fibre from the retted stem, washing, and drying.

A well-grown crop may be 12 ft. high or even higher, and the yield of fibre may be from 30 maunds (over a ton) per acre in exceptional cases to 10 maunds or even less. The Government standard of 15 maunds (3 bales) per acre seems to be a fair approximation to an average yield for the whole tract.

The jute grown in Bengal has been carefully classified. There are two botanical varieties, viz.:—

(*a*) *Corchorus olitorius* (long-fruited jute), locally known as "desi" or "tosha."

(*b*) *Corchorus capsularis* (round-fruited jute).

The former is more commonly cultivated in the districts round Calcutta; it is a heavy yielder, but its fibre is slightly coarser than that of *C. capsularis;* it does not thrive on lands which become deeply submerged, but its cultivation is on the increase on high land farther north.

C. capsularis forms the bulk of the jute crop, being practically the only kind grown over the whole of the great northern tracts of Purnea, Rungpore, Mymensingh, etc. If it reaches the height of about 5 ft. before the soil becomes submerged it will continue to thrive even though the water becomes several feet deep.

Included in each of the two species named above are numerous varieties, viz.:—

(*a*) Red-stemmed and green-stemmed.

(*b*) Early and late.

(*c*) Tall and short.

Some kinds also yield better fibre than others. A very careful classification and comparison of all the races which could be found has been made, both as regards yield of fibre and quality of fibre, and pure line selections were made in the light of the knowledge thus gained. Large quantities of pure seed of the best quality are now becoming available, and the Government of Bengal has already committed itself to the establishment of large seed-growing farms.

By careful cultivation and by using the best seed it is possible that an increase of the order of 15 to 20 per cent. in the yield of fibre is ultimately possible from the area at present actually under jute, but such a result will naturally take some years to achieve.

About one-half of the raw fibre produced is consumed in the Calcutta mills, the other half being distributed between the foreign manufacturing centres. The fibre intended for Calcutta mills is often either packed in loose bundles (drums) of one maund each or bulked in three-maund bales. For export the five-maund bale is universal.

In 1910 there were 45 mills in Calcutta, working 677,000 spindles and 33,000 looms, and employing 204,000 hands. The total share capital, which is to a very large extent European, of these mills approximates to £10,000,000.

Statistical details with diagrams are given in the paper regarding the exports of raw and manufactured jute to various destinations.

The paper also deals with the pressing need of increasing the output of jute:—

(*a*) By improved methods of cultivation.

(*b*) By extending its area.

(*c*) By increasing the production of fibres which can be used as substitutes for jute.

Adulteration and the deterioration of baled fibre known as "heart damage" also receive attention.

[Discussion.]

The Chairman: Gentlemen—I am sure we have listened with much interest to Mr. Finlow's paper on jute, and I may say, speaking as one who has been connected with the jute trade for many years, that his reasoning appears to me to be quite sound. I noticed that the value he put upon the jute was, comparatively speaking, a low one; because, if we take last year, the value of the jute grown in Bengal would be something like 60 million sovereigns, that is on his own figures of a ten million bale crop. There is no doubt whatever that the expansion of the use of jute goods has been

very marked in the last ten or twelve years, and although, like every other trade, there are times when there is a lull, the demand has always been for more jute and more gunnybags, until at the present moment I am quite certain that the stock of raw jute and of gunnies held throughout the world is smaller than any of us in this room have ever known it to be. Usually spinners hold a three months' stock of the raw material in order to have the jute to spin for orders for cloth, etc., but during the last three years, although the jute crop has been comparatively large, the spinners all over the world have been left short of jute, and at the present moment there is not enough of last year's crop to go round. It was most unfortunate for India that the crop of jute last year was spoilt by weather, which is one of the conditions that we always have to contend with. I think I am right in saying that last year at this time we had promise of the largest jute crop on record. The figures pointed to it, and everything went on favourably for a time, but in India the rain and the climate play a large part in our industries, and last year they played havoc with our jute, so that instead of getting ten to eleven million bales, we got only nine million. That was most unfortunate, because when jute has climbed to the price it has—it stands at £30 to £32 per ton—all sorts of ideas are apt to arise about using some other cheaper fibre, and spinners look around to see what they can get instead of jute, which, of course, would be a bad thing for our jute monopoly in India. But we are not without hope that, although the climate at present is playing us false again by rather weak monsoon, we have a large crop on the ground; and if that crop is allowed to go through the normal course, I think it very likely that we shall have a better surplus than we have had for several years. It is most desirable that we should have this, because jute at £30 is not what we want; what we want is jute at £12 to £15.

There is another point that Mr. Finlow referred to which I should like to confirm, as it plays a great part in this industry, and that is, the increase in the cost of labour. Some of you in this room perhaps know, though perhaps others may not know, that jute is cultivated in small patches; there is the father, the mother, and the children; and they are all engaged on it. The father cultivates the ground, and the mother helps, while the children kill the crickets. But when they have to go outside their own patches, and import labour to help them, the price of jute goes up. So I think I am right in stating that the cost of the production of jute has risen to such an extent that cheap jute is scarcely possible. It used to cost, as Mr. Finlow has told you, 8 annas to 1 or 2 rupees to cultivate it, but now it is nearer 5 rupees. This is more than it

should be, because what we want are large crops of jute, and cheap jute, to satisfy the demands of the world, and to continue and to extend the use of the manufactured goods.

I am sure you will join with me in thanking Mr. Finlow for the very interesting paper which he has read to us this afternoon.

THE PRESENT POSITION OF FIBRE CULTIVATION IN THE GERMAN COLONIES.

By Professor Dr. W. F. Bruck,
Professor of Tropical Agriculture, University of Giessen, Germany.

[Abstract.]

The most important Colony from the point of view of fibre cultivation is German East Africa, where cotton and sisal hemp are grown and where formerly Sansevieria and Mauritius hemps were produced. The last-mentioned fibres, however, have practically ceased to be exported. In Togo cotton is of some importance; in addition, sisal has of late years been cultivated there, the amount produced being only 20 tons. Sisal is also grown in New Guinea.

Isolated experiments with fibre plants have been begun in other Colonies, but they do not require mention in connection with the world's commerce. Mr. Schanz having undertaken to read the paper on cotton growing in the German Colonies before this Congress, I may limit my remarks to coarse fibre cultivation. Extensive experience has hitherto only been gained in German East Africa, where this cultivation has been carried on for about 25 years. The cultivation has proved most successful where worked on a large scale. Therefore it can only be carried out in a profitable manner by sufficiently well-founded companies. In point of fact, the bulk of this material exported from our Colony is produced by a limited number of plantations only. The total amount exported last year was 20,834 tons.

Formerly the hemp was decorticated by so-called "raspadores," *i.e.*, simple apparatus worked by hand. Now all large undertakings have given them up in favour of larger machines worked by power. The machine which is most commonly used in East Africa, Krupp's "Corona" machine, decorticates 100,000 to 120,000 leaves daily. The labour question alone absolutely demands the use of such large machines. Since a single sisal plant produces about 250 leaves during the

term of its life, it is easy to estimate that for profitable cultivation of sisal the area available must be very large.

The greatest care must be exercised in the choice of a country suitable for the growth of the Agavæ. It is not quite easy to lay down general rules with regard to soil and climate. Many mistakes have been made here, and thus much capital has been lost. Altogether, the cultivation of sisal is by no means easy. In conclusion, it should be especially emphasized that sisal hemp is, and will probably remain, a comparatively unimportant item in the world's commerce, and that, therefore, too intensive cultivation might easily lead to overproduction.

[Discussion.]

The Chairman: Gentlemen—If no one has any remarks to make I will thank Dr. Bruck most heartily for his paper on sisal hemp cultivation. Although very much interested in fibres, I am bound to say it was quite news to me to hear that such an important industry was being developed in German East Africa. There was one part of Dr. Bruck's paper which struck me as being rather on the pessimistic side, namely, where he said that the increase in the production of this fibre might lead to a fall in price. That, of course, is quite true, and the reasons he gave for his opinion are quite intelligible to us all. But if those of us who have been connected with fibres and have studied the advance in the use of fibres throughout the world will think over this question, and look at the history of the past twenty or thirty years, we shall see, I think, that although there may be times when there are lulls in the demand for fibres of various kinds, yet every year more and more uses are being found for fibres, and there is little doubt that all fibres which foreign countries produce can be utilized. And if we look back ten years hence upon what has been said to-day as to the extension of the use of fibres, we shall wonder why it was said; we shall say we did not think their uses would have extended so much. I feel certain that in regard to the possibilities of extending the market for fibre, whether it is jute, or sisal hemp or any other hemps, we have still a very long way to go. One factor which will make the extended use of the manufactured goods more certain is the production of an ample and cheap supply of the raw material. That is what we want; cheapness in the production, which will bring down the cost. I am sure that the cheaper we can produce these fibres the more extended will be the use of them.

I again, on your behalf, thank Dr. Bruck for his most interesting paper.

PROJET POUR L'ETABLISSEMENT D'UNE METHODE RATIONNELLE POUR LA DETERMINATION DE LA VALEUR COMMERCIALE DES TEXTILES.

Par Professeur C. DE MELLO GERALDES,

Directeur du Laboratoire de Technologie coloniale et du Musée agricole colonial de l'Institut supérieur d'Agronomie, de Lisbonne.

[ABSTRACT.]

Ce mémoire constitue un essai pour l'établissement d'une méthode générale et rationnelle pour la détermination de la valeur commerciale des textiles.

La méthode proposée par l'auteur consiste dans la détermination des principales caractéristiques de chaque échantillon de textile, la multiplication de chacune par un coefficient approprié, additionner ensuite les produits et comparer les totalités ainsi obtenues pour chaque échantillon, avec la somme des caractéristiques du textile pris comme type, après les avoir de même multiplié par les coefficients respectifs.

On obtient ainsi les valeurs relatives des textiles, dont on veut déterminer la valeur. Au moyen de la formule $C = \frac{Ct \times Vr}{100}$ on obtient les cours respectives : C représente le cours que l'on prétend calculer; Ct le cours de la fibre-type, et Vr la valeur relative du textile.

Pour faciliter la détermination de la valeur relative et du cours de différents échantillons on peut établir deux tableaux.

L'auteur après l'exposition de sa méthode présente comme un exemple son application à la détermination de la valeur du sisal.

Par égard à l'importance du sujet, l'auteur ajoute " qu'il conviendrait que le 3me Congrès International d'Agriculture Tropicale prenne l'initiative de nommer une commission internationale, qui serait chargée d'établir une méthode rationnelle pour la détermination de la valeur commerciale des différents textiles, et d'obtenir son adoption dans tous les pays."

[TRANSLATION.]

SCHEME FOR THE ESTABLISHMENT OF A PRACTICAL METHOD FOR THE DETERMINATION OF THE COMMERCIAL VALUE OF FIBRES.

This paper is an attempt to establish a general and practical method for the determination of the commercial value of fibres.

The method proposed by the author consists in the determination of the principal characteristics of each sample of fibre, the multiplication of each by an appropriate coefficient, then to add the products and compare the totals thus obtained for each sample with the sum of the characteristics of the fibre taken as type after having multiplied them in the same way by the respective coefficients.

The relative values of the fibres, of which it is desired to determine the value, are thus obtained. By means of the formula $C = \frac{Ct \times Vr}{100}$ the respective prices are obtained: C represents the price which it is desired to calculate; Ct the market price of the type fibre, and Vr the relative value of the fibre.

To facilitate the determination of the relative value and of the price of various samples two tables may be drawn up.

The author, after explaining his method, offers as an example its application to the determination of the value of sisal hemp.

In view of the importance of the subject, the author adds that "it is expedient that the Third International Congress of Tropical Agriculture shall take the initiative in nominating an international commission which shall be instructed to establish a practical method for the determination of the commercial value of the various fibres and to secure its adoption in all countries."

The CHAIRMAN: Gentlemen—We are very much indebted to Professor Geraldes for the very interesting paper which he has read. It is not easy, at short notice, to discuss the proposal which he has made for the testing of fibres, but we hope later on to have an opportunity of reading it and studying it. On your behalf I desire to thank him most cordially for his contribution.

The following papers were taken as read:—

THE FIBRE INDUSTRY OF MAURITIUS.

By F. A. STOCKDALE, M.A., F.L.S.,
Director of Agriculture, Mauritius.

[ABSTRACT.]

The fibre industry is, after sugar, the most important agricultural industry of the Colony of Mauritius. The fibre is obtained almost entirely from plants of *Furcraea gigantea,* which grow wild in all districts of the Island. These plants are locally called "Aloes," and two varieties occur, viz.,

"Aloes Malgache"—*Furcraea gigantea* and the "Aloes Creole"—*Furcraea gigantea* var. *Willemeliana.* The Aloes Creole contains a larger percentage of fibre than the Aloes Malgache and grows more rapidly. It is estimated that there are approximately 20,000 arpents (1 arpent equals 1·05 acre) under aloes in the Colony. In the higher districts the plants grow more slowly than in the warmer districts around the coast, and it is in these coastal districts that the majority of the factories are situated. In 1913 there were 42 factories in operation, of which 25 were situated in the Black River District. During recent years planting of Aloes Creole (*Furcraea gigantea* var. *Willemeliana*) and Sisal (*Agave sisalana*) on a plantation basis has taken place. The plantings of sisal have grown satisfactorily, but in many cases irregularly, while the plantings of Aloes Creole have proved very satisfactory. It is estimated that there are 60 to 75 arpents planted with sisal in the Colony, and 1,500 of Aloes Creole. The latter are now generally preferred, as they require less attention in the early stages of growth and grow with much greater regularity.

Factories.—The factories are all small ones—their outputs ranging from 50 to 150 tons with an average of about 55 tons of dry fibre per factory. The leaves are brought to the factory by tramway or by ox-carts. They are scraped by grattes (raspadors), two men working at each gratte. The green fibre is then washed and afterwards allowed to soak for from 36 to 48 hours in soapy water for disintegration of attached particles of pulp previous to bleaching. Bleaching and drying are carried out in the sun, and finally the dry fibre is brushed in brushing machines before being baled for shipment.

Cost of Production.—The cost of production varies between £11 and £15 per ton of dry fibre. The various items that make up these expenses are discussed, and a brief description is given of the attempts that are being made to reduce the costs of production in the factory. The fuel item, in the past year, has been greatly reduced by the installation of suction-gas plants worked with charcoal. The Government has also taken the matter in hand, and is installing at a central spot an automatic decorticating plant with a view to ascertaining if further reductions of costs cannot be effected.

Capital and Possibilities for Extension.—The industry is worked on as little capital as possible, and therefore it does not increase as fast as might be expected. However, there are signs that closer attention is being paid to making new plantations. With regular plantations and attention to cultivation the industry will be capable of attracting attention from

capitalists. The possibilities of the extension of the industry are discussed and estimates given as to costs of making regular plantations. There are large areas of land which are well suited for plantations of fibre, and with wider plantings centralization of factory working may be possible.

Yield of Fibre and Value of Exports.—The yield of fibre is discussed in detail, and the results of laboratory analyses recorded. The expenses are itemized and the average value of the fibre given.

The exports are sent to the United Kingdom; from there they are reshipped mainly to Germany. During the past two years, however, there has been a demand for Furcraea fibre in the United States of America, and a large percentage of the exports of Mauritius have found their way to that country.

RISULTATI DELL'ACCLIMATAZIONE IN SICILIA DELL' *AGAVE RIGIDA* VAR. *SISALANA*, ENGELM.

Per Professore Calcedonio Tropea.

[Abstract.]

Accertato che l'*Agave rigida* var. *sisalana* vegeta bene nella Sicilia, su terreni aridi e pietrosi, l'autore ha raccolto dati economici in rapporto alle norme colturali. In base a questi egli conclude che:—

(1°) Lo sviluppo cui giungono le piante, chiede una distanza minima di due metri.

(2°) Ogni pianta produce almeno 30 foglie l'anno.

(3°) Per estrarre un chilo de fibre occorrono circa 73 foglie.

(4°) Il prodotto medio di fibre per Ea. è di quintali 10, che al prezzo minimo di L.80 danno un introito lordo di L.800. Dalle quali prelevando le spese di coltura e sfibratura, pressa, imballaggio, ammortamento macchine e capitale fondiario, resta un introito netto di almeno 150 lire per Ea. Il prezzo è calcolato sulle fibre più corte (m. 1·10).

(5°) La "sisalana" quindi pùo utilizzare terreni aridi della Sicilia, disadatti a qualsiasi altra coltura.

[Translation.]

RESULTS OF THE ACCLIMATIZATION IN SICILY OF *AGAVE RIGIDA* VAR. *SISALANA*, ENGELM.

As it has been ascertained that *Agave rigida* var. *sisalana* does well in Sicily on arid stony soil, the writer has collected economic data with respect to the methods of cultivation. On the basis of these data he arrives at the following conclusions:—

1. The development reached by the plants requires a minimum distance of two metres.

2. Every plant produces at least 30 leaves per annum.

3. In order to obtain one kilogram of fibre, 73 leaves are required.

4. The average yield of fibre per hectare is 10 quintals, which, at the minimum price of L.80, gives a gross yield of L.800. By deducting from this yield the expenses of cultivation and extraction, pressing, packing, sinking fund for machinery and capital invested, there remains a net yield of at least 150 lire per hectare. The price is calculated on the shortest fibre (1·10 metre).

5. Sisal hemp may, therefore, be grown on arid lands in Sicily which are unsuitable for any other cultivation.

THE PAPER MAKING VALUE OF TROPICAL FIBRES.

By Clayton Beadle and H. P. Stevens.

[Abstract.]

A history of attempts to utilize tropical fibres submitted at the Indian and Colonial Exhibition.

Utilization of cotton-seed fuzz.

Utilization of sugar-cane, Megasse, *Cyperus papyrus* ("Sudd"), bamboo, various varieties of *Hedychium*, *Amomum*, *Alpinia*, and allied plants.

THE FIBRES OF THE NETHERLAND EAST INDIES.

By the Department of Agriculture, Buitenzorg.

[No abstract supplied.]

MONDAY, JUNE 29.—AFTERNOON SESSION, 5 P.M.

Chairman: Monsieur E. BAILLAUD, *Secretary-General of the Colonial Institute, Marseilles, Vice-President of the Congress.*

THE FIBRE INDUSTRIES OF BRITISH EAST AFRICA.

By A. WIGGLESWORTH.

[ABSTRACT.]

THE discovery of large areas of *Sansevieria ehrenbergii* in British East Africa first drew the attention of pioneers to the possibility of developing a fibre industry in that country. Concessions were granted by the Government authorizing the cutting of this plant, notably in the Voi district, and machinery was installed to automatically crush and clean the leaf. A merchantable fibre was obtained and was sold at prices under those ruling for sisal.

Having witnessed the success of the sisal plantations in German East Africa, Mr. Campbell B. Hausberg, backed by Messrs. Swift and Rutherfoord, in November, 1907, conceived the idea of planting sisal (*Agave sisalana*) in the uplands on the rich lava-covered plateau in the Thika district. He ploughed, cross-ploughed, and cultivated this land with oxen, and planted bulbils obtained from German East Africa. At first these were spaced 7 ft. by 7 ft., but gradually wider until 8 ft. by 8 ft. (say 650 plants per acre) became the established practice. The plants grew well and were ready for cutting in two and a half years. Several cuts, representing about 160 leaves in all, were taken during the following two to two and a half years, yielding during the life of the plant a total of three tons of dry fibre per acre. An automatic decorticator of Messrs. Krupp's make was installed by October, 1911, driven by a 70-i.h.p. suction-gas plant, turning out two tons

of cleaned dried fibre each day of eight or nine hours. The fibre is carefully washed after decortication to remove the acrid juices, then dried on lines in the sun, after which it is graded into Prime and Good qualities, each long and short, and compressed to about 80 cubic feet to the ton in a Bijoli baling press. It is then carted to Thika, railed to Mombasa, and shipped to the consuming markets. The quality is as good as can be produced and is an improvement on that of Mexico, the original home of the sisal industry.

The cultivation of sisal in this area being an assured success, planting is steadily progressing, and a large increase of production may be looked for. The conditions of climate, soil, and labour are highly favourable and enable the planters to produce sisal at a lower cost than in any other country.

Sisal planting on coral soil is extending along the coast line. Here the conditions are very different. Cultivation by machinery is debarred owing to the absence of draught animals in this tsetse-fly belt. Consequently native methods of cultivation are adopted, the land being prepared by the rude native "jembie" (hoe). The nature of the soil precludes planting with the same regularity as in the rich volcanic upland soil, against which the coast plants are spaced closer, ranging up to 1,000 or 1,200 per acre. The growth of the plant is less luxuriant, and there is less pulp in the leaf. The out-turn of fibre appears to be rather less per acre than in the uplands. The same machinery is installed here, but on one plantation a machine of British origin, made by Messrs. Robey and Co., Ltd., is giving good results.

Methods vary in different sisal-producing countries. A study of the practice in Mexico and Java reveals the advantages enjoyed by planters in East Africa, and contributes to the conclusion that, provided an adequate labour supply be ensured, the industry must become the most important of East Africa because of the unrivalled conditions, viz.:—

(1) Unequalled climate,
(2) Fertility of soil,
(3) Cheap native labour,
(4) Low-priced land,

contributing to a low initial cost when compared with the average selling price of the last ten years (£33 per ton).

The world's total consumption of hard fibres, which comprise Manila, sisal, and New Zealand hemps, used mostly for rope and binder twine, is 360,000 tons per annum, and it is increasing at the average rate of 4½ per cent. per annum. If excessive quantities of sisal be suddenly thrown on the market without any curtailment of production elsewhere, a fall in price may take place, but the cheapest producer must of

necessity displace others who, through antiquated methods or less suitable conditions, are unable to compete favourably.

The future success of the sisal industry of British East Africa seems therefore assured.

[Discussion.]

Mr. T. Thornton: Mr. Chairman—I shall be glad if the lecturer will give us some idea as to the climatic conditions of East Africa. Some of us come from other parts of Africa, and it will be interesting to know if the climatic conditions are similar in East Africa to what they are in the parts of the Continent where we are working. In Nigeria at a certain time of the year the atmosphere is very moist, and then it changes, and is as dry as it has been moist during the other part of the year. I wondered if sisal would be able to withstand a change from a very damp climate to a very dry one.

Mr. Wigglesworth: The climate varies very much in British East Africa. You have one climate at the coast, another at a higher altitude, and still another higher up. The rainfall all over Africa is one of the most peculiar things; it varies so much. You will get a valley deprived of rainfall, and then on the top of the hills looking over that valley, not more than five or six miles off, you will have a copious rainfall of 50 or 60 inches, or even more. In German East Africa, as far as can be ascertained the climatic conditions are not very different from those of British East Africa, especially on the coast. But the Germans have not cultivated sisal to the same height that we have.

Mr. Manhire: I should like Mr. Wigglesworth to give us some rough idea of what it costs to land a ton of fibre in England. He has given us working costs and so on, which will be very useful, but they want a little following out. If we could get it just roughly for purposes of reference, it would be very useful.

Mr. Wigglesworth: I think that is a question which is rather difficult to answer, because obviously those who know have it in confidence from those who plant and produce the fibre; and I do not think they would care to publish the information. I will only say that the cost of growing sisal in East Africa, especially in the uplands, is, as far as I can find out, the lowest in the world.

The Chairman: I will conclude by proposing a vote of thanks to Mr. Wigglesworth for his clear and informing lecture on this very interesting subject, which is certainly a most interesting question to all colonies and all tropical countries. I ask you all to join with me in thanking Mr. Wigglesworth.

TUESDAY, JUNE 30.—MORNING SESSION,
10.30 A.M.

Section V.—Cotton.

Chairman: THE RIGHT HON. LEWIS HARCOURT, M.P.,
Secretary of State for the Colonies.

THE PRESIDENT: Gentlemen—I have much pleasure in introducing to you Mr. Harcourt, the Secretary of State for the Colonies, who has kindly consented to take the chair this morning. Mr. Harcourt has taken a great personal interest in the success of this Congress, and has rendered it considerable assistance. As you are aware, he is one of our Honorary Vice-Presidents, and he and Mrs. Harcourt came the other evening, at some personal inconvenience, to receive the guests at the Government reception. I can also assure you that Mr. Harcourt's interest in our work is not merely nominal. Since the time of Mr. Chamberlain no Colonial Secretary of this country has shown more interest in everything that pertains to the development of the tropical colonies than has Mr. Harcourt. On that account I am sure you will welcome him to-day, and I will now call upon him to take the chair.

The CHAIRMAN, who was received with applause, said: Gentlemen—I take it as both an official and a personal compliment that I should have been invited to preside even for a short time—and I am afraid that with my other occupations it can only be for a short time—over your deliberations and your discussions to-day. As Secretary of State for the Colonies I am naturally and primarily interested in the great growth in the production of cotton within the British Empire which has been so remarkable a development of our tropical agriculture within the last ten years. On this branch of the subject, with which I have perhaps something more than a departmental acquaintance, I will venture to offer some brief observations in a moment; but first of all let me say that I realize that this Conference, remarkable alike from the subjects of its consideration and the distinction of its delegates, is not solely of a British or a Colonial but of an International

character. With that view of its composition also I am in sympathy in another than my official capacity, because I happen to be a Member for a division in Lancashire, in the very heart of the spinning and weaving district of the cotton trade. There you may be sure that my friends and I look not so much to the nationality or to the origin of the cotton, as to its quality, its abundance and its price. Lancashire would like to see the whole world production of cotton greatly and rapidly increased so long as markets were available for the finished article of their manufacture; and we must always remember that cheapness of production invariably, or nearly invariably, carries with it or produces a corresponding increase in the demand and the consumption. We in Lancashire have suffered at times from scarcity of the raw material, which has been an experience common to the whole world, but we have also suffered and resented certain operations for cornering the supply, which have brought no profit to the producer and have sometimes produced destruction to the manufacturer. In times of scarcity in the past we have looked to other and to unaccustomed sources of supply, but strange varieties and qualities do not readily commend themselves to, or become immediately popular amongst, the masters or the operatives.

I recall the often quoted story of the prayer of the old Lancashire spinner at the time of the American cotton famine of 1863: "O Lord, send us more cotton, but no more Surat." Well, I daresay that the protective prayer of that spinner would be less fervent to-day because I believe that the quality, and especially the cleanliness, of Indian cotton has been greatly improved. But it is a mistake to think that you can grow any kind of cotton and be sure of finding a market for it immediately.

I look with some alarm—if I shall not shock Mr. Sands in saying so—at a tendency, which I think is evident, of an endeavour to grow only, or mainly, the finer grades of long staple which naturally command the highest price where a market can be found. I am not, of course, surprised at the temptation when I saw at the Rubber Exhibition the other day a sample of Sea Island cotton grown in the Island of St. Vincent which had been sold at forty pence per pound, but you cannot compel the whole world to dress or to sleep in fine muslins and lace, and for the present, and probably for many years to come, the staple of this great industry is likely to remain in the future as in the past of a quality known as Middling Upland. There is no doubt that the trade in many parts of Lancashire is tending more and more towards the finer counts, and is consuming the products of Egypt and the Sudan and many of our Colonies and Protectorates, but we are bound to bear in mind the economic results of a decrease

in the quantity of raw material consumed and a corresponding decrease in the number of operatives employed in the manufacture. Nor can we assume that we can grow any variety of cotton everywhere. Nature is conservative, resistant, reactionary—I do not mean that those terms are always synonymous—but if you were to sow Sea Island seed in Nyasaland or Uganda it does not follow that it will come up as Sea Island, but probably as a variety of its own. Every country seems to have, or to produce, its own type, and one of the principal problems of modern cotton growing in new lands is to fix and to select the type and to get a standardized product which the markets will know, will look for and will buy. But it takes a long time to get a regular market with a good steady price for new varieties, and I should like to say that no one has done more in this direction for us than Mr. Wolstenholme of Liverpool, who has spared no pains to familiarize new and strange types to the Lancashire cotton industry. We owe—and I am glad to have this opportunity of saying it—a deep debt of gratitude to the British Cotton Growing Association for the care, the money and the labour which they have devoted to the inauguration and the control of cotton production in many of our Colonies. I know that you have had an illuminating address from their admirable and indefatigable Chairman, Mr. Hutton, and I do not propose to traverse the ground he has already covered; but I may remind you that the British Government itself has been contributing £10,000 a year to this Association, a grant which will have lasted for six years when it comes to an end in 1916; and the local Colonial Governments have also made large, though more indirect, contributions to cotton growing both by facilities for transport, by their Agricultural Departments, by their botanical stations, and by their campaigns against insect pests. Nothing is so vital to the cheapness of cotton as quick and economic transport. I am at this moment making great efforts to improve the railway communications of Nyasaland, the East African Protectorate and Uganda by a loan of £3,000,000 sterling, for which I am asking the authority and the credit of the Imperial Parliament.

From Uganda the export of cotton has increased five fold in the last fifteen years. In Nyasaland tobacco looks as if it might be a serious rival; but in the northern districts of Nyasaland the industry has become firmly established amongst the natives, and in East Africa, the Kaverondo tribe in the Kisumu Province have taken up cotton growing with avidity; but we must always remember that the untutored African is at first averse from growing anything which he cannot eat.

But there is one portion of our East African Protectorate to

which I look in the future with much hope and interest though its development may take years to mature—I mean that part on its north-eastern frontier along the Juba river. I am glad to see that we are to have at our session to-day papers from the distinguished and welcome delegates from Italy—papers on the question of the prospects of cotton in Italian Somaliland, which joins our frontier on the Juba river. But I feel that in this matter we ought to do more than join frontiers—we ought to join hands. In the arid parts of the tropics the salvation of agriculture is water conservation and irrigation. There is hardly a self-respecting Colony or Protectorate or possession which has not been infected with the prevailing fashion and got its own barrage. Our Northern Somaliland offers no openings for agriculture—if Dr. Brockman will forgive me for saying so—its principal products, for which there is no European demand at present, are camels, dervishes and Mullahs. But in Italian Somaliland to the south where it joins our territory on the Juba river I think there is a great opening for future development. I am told that the Juba river, being constructed by a far-seeing, one might almost say a commercial, Providence, is a series of terraces which might form a succession of natural barrages if only the upper course of masonry is added by human agency. If this is done there are miles of suitable land on each side of the river which can be irrigated by gravitation with a prospect of unlimited crops of cotton and other tropical products.

I hope I shall not appear in my enthusiasm to be using the language of a company promoter. I do not suggest to anyone that they should rush to peg out claims on the Juba. They will find anything but a friendly reception from the Marehan tribe, against whom an expedition has recently been sent. But the reason I allude to this matter is that we have here delegates from Italy, and I would like to say to them: "When you go back to Rome worry your Foreign Office to make an agreement with us over the waters of the Juba river, and I will do the same here." Foreign Offices are notoriously inert, but if each pushes from our own side we may overcome the *vis inertiæ*. Italy and Great Britain have been the best of friends for fully a century. It is a memory of pride to us that British statesmanship played no small part in the emancipation and unification of the Italian states, and I should be glad if it proved possible in the future for us as neighbours in a new continent to pursue a commercial *entente* which would contribute to the industrial prosperity of both our lands. I should like to see some of those savage tribes handling the boll rather than the spear; and I hope to see the gin of cotton some day replace the gin of commerce.

On the West Coast of Africa some progress is being made.

In the Lagos Province we had an output of 13,000 bales last year; and with the rapid progress of railway extension we hope for even larger results from the north of Nigeria, though there, of course, at present a great deal of the cotton is locally consumed in making the very fine Hausa cloth which is sometimes a formidable competitor with the looms of Europe. Even Australia has caught the infection and experiments are now to be tried in Queensland, though there the element of the cost of labour forms a serious and what may prove to be an insuperable obstacle.

Meeting as we do in this building I cannot omit to pay my humble and admiring tribute to the excellent work which has been done by the Imperial Institute and its capable staff under Professor Dunstan. No one who has not been like myself in constant touch with their work can realize how wide is the range of their work, experiments and inquiries. It is not cotton alone but every product of our tropical lands which comes under their inquisitive, I might almost say, acquisitive, observation. From cotton to coal, oil to timber, butter to metals—nothing comes amiss to their retorts, test tubes and microscopes. The merchants of England, the commerce of our Colonies, the prosperity of our Protectorates owe more than they know and far more than they are ever likely to repay to the work and the wisdom of those who are labouring within these walls.

The position of a Secretary of State for the Colonies in these latter days is as fascinating in its variety as it is overwhelming in its labours, but it is made endurable by the knowledge that the almost autocratic powers it possesses may be, and I hope always is, exercised for the collective and the individual benefit of the millions over whom it rules. In these days the Colonial Office has more of the attributes of an immense trading concern than in the earlier days when it was a mere machinery of Government. Our days and nights are spent in the study of medicine which is daily becoming more abstruse in the diseases which it tackles, and happily more curative and more preventive in its results. Our time is devoted to railway construction, with a desire that the smallest sum of money may lay the largest number of miles of track in the fewest possible number of days. I am a coal and a tin miner in Nigeria, a gold miner in Guiana; timber in one Colony, oil and nuts in another, cocoa in a third; copra and copper, sisal hemp, cotton, coffee and tobacco are common objects of my daily care. All this has been done by wise and generous expenditure by the people of Great Britain, and to-day nearly every Colony and Protectorate is self-supporting and requires no grant in aid. But in return for all that has been done in the past the Motherland exacts no tribute from her prospering sons. She

is content with the knowledge that her sacrifice and her confidence have contributed to the profit and to the happiness of all her people.

I will add only one word in conclusion. All this splendid work has been, and is being, done by the energy, the self-sacrificing zeal, of what I must be allowed to call the best Colonial service which the world has ever seen. Some people assess the value of their national greatness by wealth or by conquest. I would sooner trust the credit of my country to the character and attainments of the devoted band of men in the service who carry the name and the fame of our country to the uttermost corners of the habitable globe.

Dr. Oberto Manetti (Italian Delegate): Mr. Chairman—I am sorry I am unable to express my thanks to you, Sir, in English for your kind references to my country, and I trust that you will allow me to do so in Italian.

Sono commosso per le parole veramente gentili che V. E. ha avuto per il mio Paese e per gli attestati di stima che Ella ha voluto dare agli studiosi Italiani che hanno parpecipato a questa riunione imponente.

Al mio ritorno in Patria, sarà mia cura informare il Governo Italiano ed i colleghi, che mi hanno inviato a Londra a rappresentarli, delle speciali cortesie che l'Inghilterra ha voluto tributare all'Italia, per il che io fin da ora anticipo i piu sentiti e profondi ringraziamenti.

[*Translation.*]—I am deeply affected, Sir, by the very kind words in which you have spoken of my country and by the expression of the esteem in which you hold the Italian contributions to this Congress.

On my return to my native land it will be my pleasant duty to inform the Italian Government and those of my colleagues who commissioned me to represent them in London of the great courtesy which England has shown to Italy, for which I now wish to anticipate them in expressing our deepest and most hearty thanks.

The following papers were then read:—

THE PRODUCTION OF FINE SEA ISLAND COTTON IN THE WEST INDIES, WITH PARTICULAR REFERENCE TO THE ST. VINCENT INDUSTRY.

By W. N. Sands, F.L.S.,

Agricultural Superintendent, St. Vincent.

[Abstract.]

At least 130 years ago a fine cotton, presumably Sea Island, was grown in the West Indies. Seed was sent to the United

States, where, it is stated, a stock was gradually matured with an annual habit directly adapted to the climatic conditions of a limited tract of country. This special stock, according to Sir George Watt, embraces all the finest grades and most valuable cottons of the world, and is in fact true Sea Island, now known botanically as *Gossypium barbadense* var. *maritima*, Watt.

The cultivation of long-stapled cotton was never completely abandoned in the British West Indies, but was confined after the American Civil War to a small production in the Grenadines. The revival of fine Sea Island cotton growing, however, dates from the year 1901, when small experimental plantings were made in this and the following year from seed obtained from the United States. The results were so promising that Sir Daniel Morris, then Imperial Commissioner of Agriculture for the West Indies, and Mr. J. R. Bovell, Superintendent of Agriculture, Barbados, paid a special visit to the Sea Island cotton districts of South Carolina and Georgia in 1903. The valuable first-hand information which these gentlemen obtained was of much value to West Indian planters. Besides, during his visit Sir Daniel Morris obtained a large supply of seed of the fine River's type, produced on the seaboard of South Carolina. This variety is still largely grown, as are also other fine varieties obtained through the British Cotton Growing Association and others. In the year 1905 the American growers of the finest Sea Island cotton combined to prohibit the exportation of seed, but this action had little or no effect on the West Indian industry, for it was proved by this time that with careful local selection and cultivation the quality of the cotton could be maintained and in many instances improved, with the result that to-day the finest cotton in the world is produced in certain of the islands.

The chief British islands exporting Sea Island cotton are St. Vincent, St. Kitts, Barbados, and Montserrat, but the industry is successfully carried on in several of the others. St. Vincent, besides being the premier cotton-growing island, also produces the most valuable cotton. In St. Kitts, however, where the soil and climatic conditions are somewhat similar to those of St. Vincent, some exceptionally fine cotton is grown. In the paper now submitted it is proposed to refer more particularly to the St. Vincent industry, because:—

(*a*) The British Cotton Growing Association advises West Indian planters to cultivate for fineness of lint in view of the competition of certain Egyptian and American cottons with some of the cotton produced in the West Indies, but not with that of St. Vincent;

(*b*) The methods adopted in the production of cotton in St.

Vincent and the measures taken for the protection of the industry have been under closer governmental control than in any other island; and

(*c*) The highest degree of success has been obtained in the production of fine cotton.

The soil of St. Vincent is of volcanic origin throughout, and may be classed as a dark sandy loam. With the exception of St. Kitts, the soils of other islands are, as a rule, heavier in character. The rainfall of St. Vincent is ample and often excessive, and exceeds that of the other Colonies.

Mention has been made of the introduction of the River's and other fine types from South Carolina, and it is from these that the successful local industry has been built up. Great care had to be exercised at the outset to ensure that only seed from the best fields of plants true to type was planted. The seed now used for planting is all obtained from nurseries or selected crop lots, and is tested, selected, and sterilized before being sown. The seed selected must be heavy and sound with a tuft of green fuzz at one or both ends. Arrangements are made with planters by the Agricultural Department to grow special fields from seed from selected plants at the Experiment Station in order to keep up the standard of cotton grown by small growers. Most of the large estates now maintain their own nurseries. The methods adopted in plant selection are based on desirable field characters of the plant, yield of seed-cotton, length, fineness, strength, uniformity, and lustre of the lint. Plant selection for resistance to certain bacterial and fungoid diseases is also largely carried out and with promising results.

The work of maintaining the quality and yield of cotton in St. Vincent has been greatly facilitated by the enacting of certain legislative measures. Under the Ordinance for the prevention of the introduction of pests and diseases, power is given the Agricultural Authority to destroy, fumigate, or sterilize all seed-cotton or cotton seed brought into the Colony, and the provisions of the Ordinance are strictly enforced. Under the Agricultural Products Protection Ordinance all sales of seed-cotton of a less amount than 100 lb. in weight have to be made to the Government Central Ginnery, but lots up to 4,000 may be sold. The object of the action thus taken was to prevent cotton stealing, but as the Government wisely purchases the cotton on a profit-sharing basis there are few sales to licensed dealers. At the present time there is only one licensed dealer in the Colony, and the licence is held by a responsible firm who do not sell seed for planting purposes to the peasantry. As a result the seed supply is under close control.

A third Ordinance which has an important bearing on the industry is that providing for the destruction of all cotton plants at the end of each season in order to prevent the carrying over from one season to another of certain pests and diseases. As the provisions of this measure cover all kinds of cotton whether wild or cultivated, it has been possible to destroy all the perennial wild or semi-wild types and so reduce to a minimum the danger of cross fertilization of the valuable Sea Island variety with undesirable kinds.

The methods of cultivation, yields per acre, details of picking, bulking, drying, ginning, and baling are fully described in the paper, together with the chief characteristics of the lint and the uses to which it is put.

The prices obtained for St. Vincent Sea Island white cotton during the past three seasons have ranged from 2s. to 2s. 9d. per lb. for the "superfine" and from 1s. 6d. to 1s. 11d. for the "ordinary."

The industry is a remunerative one in an average of years.

THE COTTON INDUSTRY OF THE LEEWARD ISLANDS COLONY.

By H. A. Tempany, B.Sc., F.I.C., F.C.S.,

Superintendent of Agriculture, Leeward Islands.

[Abstract.]

In this paper the history of the development of the industry of the cultivation of Sea Island cotton in the Leeward Islands Colony of the British West Indies is traced.

An account is given of the conditions under which the staple is produced in the different Presidencies of the Colony.

The methods adopted to foster the growth of the industry are described, and the manner in which development has occurred is illustrated by statistics giving the detailed exports for each year since the inception of the industry.

The cultural methods in vogue are dealt with and also the means adopted to secure the maintenance and improvement of the staple by means of plant selection; this side of the work has for a number of years past constituted a very important branch of the activities of the Agricultural Department.

The principal insect and fungoid diseases to which the crop is liable are enumerated and the means adopted for their control indicated.

In the concluding sections of the paper the conditions under which the industry is carried on in each of the islands in which Sea Island cotton is grown are summarized in some detail,

while finally a general review is given of conditions affecting the stability of the industry and its future prospects.

The natural conditions obtaining in many of the islands are well adapted to the cultivation of Sea Island cotton.

The industry dates from the year 1902 and at present is carried on in Antigua, Barbuda, St. Kitts, Nevis, Anguilla, Montserrat, and the Virgin Islands. It is conducted both as an estates crop and also as a peasant industry.

Development has been assisted by the Government through the medium of the Agricultural Department and by the British Cotton Growing Association. The assistance rendered has taken the form of grants in aid of purchase of machinery, of skilled advice on the treatment of the crop, and of the provision of market facilities.

The soils on which the crop is grown include a very large variety of types ranging from non-calcareous volcanic sandy loams and loams to highly calcareous soils.

The annual rainfall in the cotton-growing districts ranges from 30 to 70 in.

The total area at present under cultivation is estimated to range from 8,000 to 10,000 acres annually.

The total exports from the Colony for each year since the development of the industry are given in summarized form below:—

Year	Exports of lint in pounds	Year	Exports of lint in pounds
1902-3	50,480	1908-9	697,423
1903-4	152,160	1909-10	690,154
1904-5	382,477	1910-11	1,371,307
1905-6	526,382	1911-12	1,073,794
1906-7	702,910	1912-13	1,149,189
1907-8	1,127,126		

At an assumed value of 1s. 6d. per lb. for lint it will be seen that during the past three years the value of the exports has ranged between £75,000 and £100,000 per annum, while the total value of the exports for the entire period during which the product has been cultivated exceeds £500,000 in value.

The importance of maintaining the quality of the strains of seed cultivated is very great. Seed of high quality was introduced into the Colony from the Sea Islands of South Carolina in 1904 through the agency of Sir D. Morris, then Commissioner of Agriculture for the West Indies; this has formed the starting-point from which the majority of the strains at present cultivated have been derived. At the present time large-scale selection work is carried out by the Agricultural Department in every Presidency, and many of the strains of

seed thus originated have found their way into general cultivation.

For its successful production the crop requires high cultivation, and in this respect the level maintained is, in practically all cases, satisfactory. Hand labour is very largely employed.

Experience has shown that each island tends to develop a type of lint characteristic of itself as the result of local soil and climatic conditions; this fact is of great importance in relation to the origin of strains of seed to be planted each year.

The principal insect pests to which the crop is subject are the Cotton Worm (*Alabama argillacea*), Leaf Blister Mite (*Eriophies gossypii*), Cotton Stainers (*Dysdercus* spp.), and the Flower-bud Maggot (*Contarinia gossypii*), the last having only proved a pest of serious importance in Antigua up to the present. Among fungoid pests must be classed Anthracnose, Angular leaf spot, and a bacterial boll rot. On the whole the insect pests must be regarded as of more importance than those of fungoid origin. In the majority of cases the various diseases and the methods of control are well understood.

Regarding the conditions under which the industry is conducted in the different islands, in Antigua the crop is grown both as a main crop and as a rotation crop with sugar; there is also a certain amount of peasant-grown cotton. The industry experienced a considerable check owing to the attacks of the Flower-bud Maggot disease between the years 1907 and 1909, but has now recovered from this to a large extent. In Barbuda the industry is carried on as an estates crop by the Government, about 130 acres being cultivated each year; the enterprise has resulted in placing the island in a solvent condition; formerly it constituted a charge on the revenue of Antigua.

In St. Kitts the crop is grown very largely as an intermediate between two crops of sugar cane, it is also grown to some extent as a main crop; there is no peasant industry. St. Kitts cotton has now attained a very favourable reputation among spinners and the industry is very firmly established.

In Nevis cotton is grown as a main crop on estates, and there is also an important peasant industry. The crop has very largely replaced sugar, and has exercised a very profound effect on the prosperity of the island.

In Anguilla the crop is almost entirely grown by peasants, and its introduction has resulted in the restoration of a moderate degree of prosperity to a community which formerly existed in a condition of abject poverty. Mention must be made of the efforts of Mr. C. Rey, who, as a local landowner and the agent of the Local Government and the British Cotton Growing Association, has assisted in bringing about the existing state of affairs.

In Montserrat the staple is very largely cultivated both on estates and by peasants; the crop now constitutes the principal product of the island, and its introduction has resulted in the re-establishment of a considerable measure of prosperity.

In the Virgin Islands the industry is conducted purely as a peasant industry, and cotton is widely grown on numerous scattered small holdings on the collection of small islands of which the Presidency is composed. The crop is purchased and exported by the Government through the medium of the Agricultural Department. Its introduction has resulted in the establishment of a greatly increased measure of prosperity among the peasant proprietary of the locality.

The industry may be looked on as firmly established in the Colony; the period of its development is brief, but in that time it has effected a very pronounced improvement in the economic conditions, and now ranks second in importance in the industries of the Colony. The present position must be attributed in no small measure to the unremitting efforts which have been made to foster development. The future of the industry depends on the continuation of favourable market conditions and on the absence of any wholesale destructive agency which does not permit of ready control.

The history of the development of the industry is of interest and serves to indicate the steps best calculated to promote the development of other agricultural industries under similar conditions.

[Discussion.]

Mr. C. M. Wolstenholme: I should like to ask Mr. Tempany why the profit-sharing scheme is not more extended in the Leeward Islands. The profit-sharing policy adopted by Mr. Sands and also in the Virgin Islands is much more suitable for commercial purposes. At present all the peasant cotton from Montserrat, Nevis, St. Kitts, and some of the other Leeward Islands is shipped in one-bale lots which are uncommercial, and they will never get a good price for their cotton until they work on the profit-sharing system. I should like to ask him why it is not adopted to a greater extent.

Mr. Tempany: With regard to the question which has been raised by Mr. Wolstenholme, I would say that in the Virgin Islands, as in St. Vincent, the ginneries are under the control of the Government. The whole of the cotton is purchased there, consequently the size of the shipments can be absolutely regulated. In the other islands the ginneries are privately owned. In some cases cotton is purchased and shipped in lots by the owners of the ginneries. In other cases the peasants insist on the shipment of their cotton, which usually comes

forward in lots of not more than one bale at a time. A remedy would be to establish in all the islands a system whereby peasant cotton was purchased at official rates based on the current market price of the staple, and officially sanctioned by the Government.

The CHAIRMAN: I am sorry to say, gentlemen, that other Colonial duties make it necessary for me to leave this interesting Congress now. I should like before I go to thank those gentlemen who have read papers; and I shall ask Professor Dunstan to take my place in the chair.

Professor Dunstan then took the chair.

FLOWER-BUD AND BOLL SHEDDING OF COTTON IN THE ILORIN PROVINCE, NIGERIA.

By THOMAS THORNTON, A.R.C.S.,

Assistant Superintendent of Agriculture, Northern Provinces, Nigeria.

[ABSTRACT.]

ONE of the most serious troubles there is to contend with in this part of Nigeria, in the growing of cotton, is the shedding of flower-buds and young bolls. It will be well understood that this trouble, if it occurs to any extent, will be of great importance in reducing the crop returns.

On arriving in the Province at the beginning of April, 1913, the old cotton which was standing indicated that shedding had been very serious during the previous season; practically no bolls from which cotton had been picked were to be seen on the lower parts of the plants; almost all the crop had been reaped from bolls which had been developed at the top of the plants.

I arranged, in conjunction with other work, to try to determine the cause of this shedding, and with this object in view made a daily record of the flowers opening, the buds and bolls shed, and of the various climatic factors.

Observations were made on different kinds of cotton, African as well as exotics.

The rainfall during August in this particular year was very heavy in comparison with other years. Between 10 and 11 in. of rain was recorded; September was lower than the average with 8½ in. The rain ceased on October 19 after nearly 5 in. had been recorded. No more rain fell until February 26, 1914.

The absence of sunshine during August, September, and early October was particularly noticeable.

The shedding of flower-buds commenced before any flowers opened, and the shedding of small bolls commenced a few days after the first flowers opened. This shedding of both buds and bolls continued as long as any were being formed.

The maximum shedding took place during the wet period, and shortly after the dry season commenced there was a great decrease in the number of sheddings. A decreased shedding continued for about ten days, and then it commenced to increase again; this continued for about three weeks and then again rapidly decreased. From then on to the end of the year, although shedding continued, the number of sheddings remained very low.

During the wet period the shedding was not uniform from day to day; on certain days the number of sheddings would rise to a very high point, and it was observable, although the climatic conditions were fairly complex, that preceding such days the relative humidity of the atmosphere had been unusually high, accompanied with a cloudy sky and generally rain.

The shedding was of two kinds: during the wet period the leaves were not shed with the buds and bolls, but during the dry season the increased shedding of buds and bolls was accompanied by the shedding of leaves.

Twenty-five per cent. of the sheddings had been damaged by the boll-worm; the damage done by these insects thus accounts for this proportion of shedding.

The high humidity of the atmosphere and the small amount of sunshine appear to be responsible for the shedding during the wet season. We cannot explain exactly what effect these conditions have on the cotton plant; it is possible that the moist conditions affect the transpiration of the plant, and in some way set up an abnormal condition in the plant which results in these organs being shed.

When the dry season commences the atmosphere becomes drier and more sunshine is obtained, and the shedding then decreases; but as the dry season advances still farther, the plants which have developed under more moist conditions begin to feel the effects of these changed conditions, and in response to the diminished water supply a shedding of the leaves takes place, together with an increased shedding of buds and bolls. New growth afterwards takes place, a new set of leaves is produced, and a new flowering period is commenced. It appears as if the plant has now accommodated itself to the new conditions, and shedding falls to a minimum point.

This latter flowering period is the one from which the principal crop is produced, and should rain fall—which, however, at this time of the year can never be depended upon—a fair

crop may be expected. This last year no rain fell during this period, and the crop obtained was most disappointing.

[Discussion.]

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): With reference to the shedding of cotton bolls, we have the same trouble in Nyasaland which Mr. Thornton is at present experiencing in Nigeria. On our lower elevations the custom was to plant our cotton at the beginning of the rains, as Mr. Thornton does at present. One year when the rains slacked off towards the end we got a good crop; in another year when there was more rain we got a bad crop largely through boll shedding. After observing the habit of the crop and its behaviour, I induced several of the estates in this part of the country to postpone planting until the end of the rains; and now in Nyasaland, instead of planting our cotton on the lower levels in the month of November, we never plant before the last week of January or the second week in February, and the results have been most satisfactory. We now get regular crops every year. Mr. Thornton pointed out that the soil in his part of Nigeria is light and the cotton dies out. I might say in this connection that I have grown Nyasaland cotton for the last four years in very light soil. I would recommend Mr. Thornton to try to select a plant which is able to survive, possessing drought-resisting properties, and he will find that he will be able to evolve from that a type of cotton suitable for planting towards the end of the rains. In my case that system has been most successful. The disease he has mentioned no doubt accounts for a certain amount of shedding. For instance, I have seen considerable boll shedding in Texas, and also in Egypt and Ceylon, due to anthracnose. The plants get tall, and you therefore get a lot of shedding of the lower limbs because the sun does not penetrate there. I think myself that in evolving a suitable type of cotton I would lay special emphasis on trying as much as possible to reduce vegetative characteristics, as undoubtedly cotton in Africa as a whole is subjected to much heavier precipitation than cotton in its natural habitat, America.

Mr. W. H. Himbury (British Cotton Growing Association): I have been greatly interested in listening to Mr. Thornton's paper. Naturally, the British Cotton Growing Association look to Northern Nigeria for great things owing to its enormous area and large population. I would therefore like to ask Mr. Thornton if last season was not somewhat exceptional as regards climatic conditions? I believe they had a very severe drought throughout Northern Nigeria. I should also like to ask him over what period his planting experiments were carried out, as I am rather inclined

to agree with what Mr. McCall has just said about planting towards the end of the rains.

Mr. W. N. Sands (St. Vincent): I have been much interested in Mr. Thornton's paper in connection with boll shedding. Boll shedding takes place, I suppose, in every part of the world where cotton is grown, and even in the production of fine Sea Island cotton we at times experience great loss in this direction. We attribute it to unfavourable climatic conditions. I do not think the time at which the cotton is planted matters so much with us, but rather the weather conditions experienced during the time the flowers are open. We notice very often that after three or four days of very dull or rainy weather, when there is very little sun, that a good number of the bolls have fallen off. I think also some varieties are more susceptible to shedding than others. I have grown a good many varieties side by side under similar climatic conditions. For instance, the Marigoland cotton is a very strong growing perennial type from the Grenadines, 6 ft. or 7 ft. high; but in St. Vincent, where we get a very heavy rainfall, it is very difficult to get any bolls to stay on the plants in the wet season, and until we get to the drier months of January or February we get no bolls on the plants at all; the consequence is we get very tall plants with all the bolls on the top. On the other hand, we have grown Sea Island side by side with Marigoland and had all the bolls on the trees. The Sea Island, we think, has become more acclimatized to our conditions than the perennial kind from the Grenadines.

Lieut.-Col. J. H. Collens (Trinidad): It is within my knowledge that Mr. Thornton has done very good work in our part of the world, in the Southern West Indies, and I should like to ask him whether he finds any difference in the growing of cotton in Northern Nigeria compared with Trinidad and Tobago. I may mention that in Trinidad there is very little grown, for reasons which are known to Mr. Thornton, but I should like to ask him whether the plants he suggests for Northern Nigeria would be suitable for Trinidad and Tobago?

Mr. Thornton: With reference to Mr. McCall's remarks, he rather inferred that I had stated we planted at the beginning of the wet season, but this is not so. The wet season commences during April, and some of my cotton was not planted until July 28; most of the cotton of which I was speaking was planted on July 15—from the 15th to the 28th. The rain ceased on October 19, so that the plants only had about three months' rain. I saw plants which had been planted later than those which I planted on the experimental farm, but very little growth was obtained from them.

Mr. Himbury asks whether the conditions were not excep-

tional in Northern Nigeria during the past year. Yes, they were exceptional. The drought was more severe, I believe, than it had been before; but my remarks were in reference principally to the shedding of bolls and of buds which occurred during the wet season. During the dry season there was less shedding; the plants did not produce so many flowers during the dry season. If more rain had fallen during the dry season, then I believe there would have been a very good crop, and no one would have suspected that much shedding had occurred. However, the principal shedding took place during the wet season, not during the dry season.

As regards Colonel Collens's question as to the conditions of cotton growing in West Africa and the West Indies, I would reply that there is absolutely no comparison. In the West Indies we were working on cotton acclimatized to the country, a type of cotton with which we had specialized. We have been carrying on seed selection work in the West Indies for a good number of years, and have brought the cotton up to such a point that, as you have heard this morning from Mr. Sands, certain cotton is being sold for as much as 3s. 4d. per lb. The cotton produced in Nigeria is being sold by the natives for 1⅛d. per lb.; probably the lint would be worth about 7d. per lb., so that you will see there is very little comparison between the two as regards the cotton.

Then, again, as regards the growers of the cotton there is no comparison. In the West Indies it is in the hands of the white man; out in Africa the white man has nothing whatever to do with it. It is a native crop that has been grown by the natives from time immemorial in order to manufacture cloth for themselves, and not with any idea whatever of putting it on the market. There is, therefore, absolutely no comparison between the cotton production in West Africa and the cotton production in the West Indies.

COTTON CULTIVATION IN UGANDA.

By Samuel Simpson, B.Sc.,
Director of Agriculture, Uganda.

[Abstract.]

The Uganda Protectorate is the largest cotton-producing country in Africa with the exception of Egypt, and statistics are given showing the gradual development of the industry from 1904-5, when 180 cwt. valued at £236 were exported, to 1913-14, when 99,924 cwt. valued at £317,689 were produced.

Uganda cotton was formerly very mixed and dirty, and the efforts made to get rid of these defects are described.

Experiments to discover the best cotton to form a basis for Uganda cotton have shown that long-stapled American Upland is the best, and work is being carried out on one of the Government plantations in acclimatizing and grading up a suitable cotton by selection.

Cotton growing is a purely native industry, and the exports are due entirely to the thousands of small cultivators, who are instructed by a large staff of natives working in every part of the Protectorate.

All the cotton seed is distributed free of charge, and over 300 tons of seed are given out annually.

Uganda cotton regularly sells at from 50 to 150 points on Middling American.

Legislation has been put into operation to help in improving and maintaining the standard, dealing with such points as the distribution of seed, uprooting of plants, hand cotton gins, licences and permits to purchase raw cotton, markets, inspection of raw cotton and ginning factories; a copy of the rules in force is given *in extenso*.

[DISCUSSION.]

The PRESIDENT: Mr. Simpson's paper is exceedingly interesting, because there is no doubt whatever that Uganda is capable of producing a very useful description of cotton for Lancashire. It is also equally true that the natives are taking up the work with great enthusiasm. In fact, the situation altogether in Uganda seems to be most promising. If anyone has any remarks to make about Uganda, I would ask that they should be made now.

Mr. C. M. WOLSTENHOLME: I have taken a great interest in this matter, and there is one point which I should like to mention. The cotton of late years has become rather longer and not so strong as it was three or four years ago, chiefly owing, I think, to the introduction of a longer staple seed from America, and it is not so readily saleable as the cotton was three years ago.

CONTRIBUTION POUR L'ETUDE DES COTONS DES COLONIES PORTUGAISES.

Par le Professeur C. DE MELLO GERALDES,

Directeur du Laboratoire de Technologie Coloniale et du Musée Agricole Colonial de l'Institut Supérieur d'Agronomie de Lisbonne.

[ABSTRACT.]

L'auteur présente dans ce mémoire le résultat de ses études au sujet de quelques échantillons de coton des Colonies Portu-

gaises, qui font partie des collections du Musée Agricole Colonial, de l'Institut Supérieur d'Agronomie de Lisbonne, dont il est le directeur.

L'auteur commence par décrire la méthode d'étude suivie, et par presenter des classifications des cotons selon la longueur, le diamètre, et la résistance de ses soies et leur degré d'homogénité.

Pour donner une idée nette des variations et du degré d'homogénité des cotons, en ce qui concerne leurs caractères les plus importants, l'auteur présente pour chaque échantillon des graphiques semblables à ceux qu'on emploie en biométrie pour représenter les variations continues, c'est à dire des *polygones de frequence ou de variation.*

Les polygones de fréquence ont été faits de façon que les fréquences représentent aussi le pourcentage des différentes classes pour cent ou pour mille.

L'auteur décrit aussi sommairement les régions qui produisent les cotons qu'il a étudié, et les essais de culture que l'on y a fait. Il indique la cotation obtenue par chaque échantillon étudié.

L'auteur présente dans une annexe des statistiques relatives à l'exportation du coton, à la surface cultivée en coton, et il indique aussi la moyenne de production par hectare.

La législation relative à l'encouragement pour la production du coton, dans les Colonies Portugaises, se trouve à la fin du mémoire qui est illustré de plusieurs gravures, représentant des plantations de cotonniers et de cotons non égrainés et 22 polygones de fréquence.

[Translation.]

CONTRIBUTION TO THE STUDY OF COTTONS IN THE PORTUGUESE COLONIES.

The author sets forth in this paper the result of his studies on the subject of some samples of cotton from the Portuguese Colonies which form part of the collections of the Colonial Agricultural Museum of the Higher Institute of Agriculture at Lisbon, of which he is the Director.

The author begins by describing the method of study followed, and by showing the classifications of the cottons according to length, diameter, and strength of the staples and their degree of homogeneity.

To give a clear idea of the variations and of the degree of homogeneity of the cottons as regards their most important characters, the author shows for each sample diagrams similar

to those employed in biometry to represent the continuous variations, that is to say, polygons of frequency or variation.

The polygons of frequency have been drawn so that the frequencies represent the percentage of the different classes per hundred or per thousand.

The author also describes briefly the regions where the cottons which he has investigated are produced and the cultivation experiments which have been made. He indicates the quotation obtained by each sample examined.

The author gives, in a schedule, statistics relating to the export of cotton, the cultivated area under cotton, and the average production per hectare.

The legislation relating to the encouragement of the production of cotton in the Portuguese Colonies is found at the end of the paper, which is illustrated by several photographs representing cotton plantations and unginned cottons and twenty-two polygons of frequency.

The President: The subject which Professor Geraldes has brought to our notice is one which everyone who wishes to see the cotton cultivation of the world extended should read. I am sure we shall read it and think over it, because it raises many important questions. He has, of course, only been able to give us a short summary of the elaborate and valuable paper which he has prepared for the Congress.

GLI ASPETTI DELLA COTONICOLTURA DELL'ERITREA.

Per Dott. Guido Mangano.[1]

[Abstract.]

La cotonicoltura assume nell'Eritrea tre forme ben distinte fra loro, ciascuna delle quali si svolge in una regione a sè, e porta ad organizzazione tecnica ed economica completamente diversa. I tre tipi sono particolarmente determinati dall' origine delle acque di cui si vale la coltivazione; dimodochè si hanno colture che possono farsi con le sole acque di pioggia o con le sole alluvioni dei torrenti, opportunamente regolate, o con le pioggie e gli inondamenti insieme. La coltura beneficata dalle sole pioggie deve limitarsi a quelle zone che per il loro rilievo o per la lontananza da corsi di acqua non possono consentire la grande coltura irrigua in nessuna delle sue forme. Tali zone sono quelle del mezzopiano sud-occidentale e, in parte, quelle del bassopiano verso i fiumi Gasc e Setit. Le varietà di cotone che possono esservi coltivate sono quelle a breve ciclo o quelle a tipo legnoso perenne.

[1] Read by Dr. Oberto Manetti.

Il 2° tipo di coltura, usufruente di acque di inondamento e, può dirsi, quasi solo di queste, trova la sua sede in quelle zone del bassopiano e del mezzopiano occidentale che sono naturalmente inondate dai corsi di acqua o che con una opportuna sistemazione idraulica possono venire irrigate per inondamento e per le quali la stagione delle piene e quella delle pioggie coincidono, come la regione del Barca e una parte del territorio del Gasc e Setit.

Le colture anche in tal caso debbono avere breve ciclo. Le regioni del bassopiano orientale, cioè della zona littoranea, che hanno pioggie invernali e una doppia stagione di piene, estiva ed invernale, possono ospitare colture dell'ultimo tipo. Il particolare regime di pioggie e piene consente si possono coltivare varietà a più lungo ciclo.

La diffusione della cotonicoltura in Eritrea dipende dal realizzarsi di molte condizioni: dall'oculata scelta delle varietà, da una accurata loro selezione, e, là dove la coltura deve essere irrigua, dalla esecuzione di lavori idraulici, oltrechè dalla soluzione del grave problema della manodopera. Altre questioni interessano molto da vicino la cotonicoltura; tra queste assai importanti, quelle relative alla unicità del tipo di produzione, alla fornitura del seme selezionato, al posto da dare al cotone nell'attività dell'azienda, alla viobilità, ai trasporti. Attualmente la coltura è poco diffusa. Gli indigeni la praticano saltuariamente e sempre su estensioni limitate. Da qualche tempo anzi, per gli alti prezzi della dura, l'hanno quasi abbandonata.

Oltre agli indigeni la coltura è esercitata du una Società Italiana in aziende situate in varie parti della Colonia; società che con le sue aziende industriali e commerciali provvede anche all'acquisto, allo sgranaggio e alla esportazione della produzione indigena.

[Translation.]

PROSPECTS OF COTTON GROWING IN ERITREA.

In Eritrea cotton growing assumes three forms, quite distinct from each other, each of which is developed in a special region, and requires an absolutely different technical and economic organization. The three types are specially determined by the origin of the water used in the cultivation, so that there are crops which can be grown only by utilizing the rain water, others which depend only on the flooding by the torrents duly regulated, and again others which benefit by a combination of rainfall and inundations. The crops which benefit by the rainfall only must be limited to those districts

which, by reason of their altitude and their distance from watercourses, cannot adopt the irrigation system in any of its several forms on a large scale. These districts are situated on the intermediate tableland to the south-west, and partly on the low plain towards the rivers Gasc and Setit. The varieties of cotton which can be grown there are those of quick growth and those of the perennial lignified type.

The second class of crops, which utilizes the waters from inundations and, we may say, practically only these waters, is to be found in those districts of the plain and of the eastern intermediate tableland which are naturally inundated by the watercourses, and which, with a suitable hydraulic system, may be irrigated by inundation and with regard to which the seasons coincide, as, for instance, the district of Barca and a portion of the territory of Gasc and Setit. In this case, also, the crops must be of quick growth.

The districts of the eastern plain, namely, the littoral zone, where there are rains in winter and two periods of inundation in summer and in winter, may be used for growing crops of the last type. The particular conditions of rains and inundations make it possible to cultivate varieties of slower growth.

The extension of cotton growing in Eritrea will depend on a variety of conditions—on a careful choice of the varieties, on an accurate selection, and, where the cultivation must be on irrigated land, on the execution of hydraulic works, in addition to the solution of the difficult problem of labour. Other questions are of great interest in connection with the growing of cotton, and, amongst these, the important questions relating to a unity of type of production, the supply of selected seed, the position to be given to cotton in the working of the concern, the selling facilities and the transport. At the present time cotton growing is not widely distributed over the country. The natives grow cotton only by fits and starts, and always on restricted areas. As a matter of fact, they have nearly given up growing cotton by reason of the high prices of dura.

In addition to the natives, the growing of cotton is being carried on by an Italian Company in plantations situated in various parts of the Colony; this Company, by its industrial and commercial agencies, occupies itself also with the acquisition, the cleaning, and the export of the native crop.

The President: I might remark with regard to Eritrea that it is a Colony in which this country is to a certain extent interested, as I believe there is one English syndicate engaged in cotton growing there. This venture seems to have some prospects of success.

We have two other papers on the list from Italy on similar subjects, but the authors are, unfortunately, not present.

If no one has any remarks to make on Dr. Mangano's paper, I will ask you to pass a vote of thanks to all the authors who have read their papers this morning.

The following papers were taken as read:—

THE COTTON INDUSTRY IN THE NORTHERN PROVINCES OF NIGERIA.

By P. H. Lamb,

Director of Agriculture, Northern Provinces, Nigeria.

[Abstract.]

The paper opens by drawing attention to the fact that cotton has been an established crop in the Northern Provinces of Nigeria from very ancient times, and that this fact has led to exaggerated ideas as to the possibilities of the country from the point of view of supplying the world's markets.

The economic conditions which control the production of cotton in Nigeria are then discussed, and it is pointed out that cotton will only be cultivated there on a large scale if the grower finds the crop sufficiently remunerative.

The country is undoubtedly admirably suited for the production of ground nuts, and this crop bids fair to become the more popular of the two.

The only way in which cotton cultivation can be placed on a surer and more permanent basis is by increasing the yield per acre and improving the quality of the staple.

The pioneer work of the British Cotton Growing Association, and the steps which it has taken since 1906 to increase the output of cotton by the establishment of buying centres, the erection of ginneries, and the free distribution of seed are then alluded to.

Statistics of the number of bales exported in the year 1913 are also given.

The paper goes on to describe the principal indigenous cottons of the country from an economic standpoint.

The latter part of the paper deals with the work which has recently been done by the newly-formed Department of Agriculture to evolve a more useful type of cotton for local cultivation. Two experimental farms were started, and exotic cottons were introduced for comparison with the local varieties.

The varieties selected for trial were Allen's Improved (Uganda seed), Nyasaland Upland, and Durango (one of the newest American types).

The relative merits of these are briefly discussed, and a table is given showing the yields which were actually obtained.

The greatest trouble experienced was "boll shedding," and this took place on such a wholesale scale on one of the farms that practically the whole crop was lost.

The main cause responsible for this loss appears without doubt to have been excess of rain and lack of sunshine during the time when the plants were flowering and setting bolls—a most critical period in the plant's life.

It is concluded that the year's results in that particular locality tend to justify the native practice of growing cotton only in conjunction with other crops, as the yield is not large enough to warrant its being treated as a main crop.

Attention is drawn to the prevalence of boll-worm and to the drastic regulations as to annually uprooting and burning the crop, which are necessary if this pest is to be kept in check.

On the other farm situated near Zaria the results were a great deal more encouraging.

Here the improved Upland cottons gave a cash return per acre nearly 100 per cent. in advance of the local varieties, and excited the admiration of the natives.

Enough seed was secured from the farm last year to sow 750 acres during the season 1914, and it is anticipated that the whole of this will be taken up by native cultivators under Government supervision, the crop being repurchased to provide seed for further extension the following year.

By this means only can satisfactory progress be made.

The paper closes by emphasizing the need of more modern methods of tillage; it says:—

"While thus endeavouring to improve the quality of the cotton of Nigeria as well as the yield per acre, we are not losing sight of the importance of reducing the cost of production by more up-to-date methods of cultivation. At present practically the whole of the arable land of Nigeria is turned over by hand, but on the Zaria farm last year a start was made in the use of implements by employing cultivators drawn by cattle to work the land under cotton. It is intended during the coming season to extend this work greatly, and if possible to induce natives to cultivate their own land by similar means, thus enabling them to employ their time to greater advantage than hitherto.

"By this means alone the agricultural wealth of the community might be enormously increased."

COLTIVAZIONE DEL COTONE NELLA COLONIA ERITREA.

Per Gino Lavelli De Capitani.

[Abstract.]

Per avere un concetto di quanto si è fatto nella Colonia Eritrea in rapporto alla coltura cotoniera è necessario analizzare l'opera della Società per la Coltivazione del Cotone nella Colonia Eritrea; e ciò pel fatto che a questa società, se non ufficialmente certo ufficiosamente, fu attribuito il compito di uno studio razionale e sistematico di detta coltura. Quindi nella memoria che viene presentata al III° Congresso Internazionale di Agronomia Tropicale a Londra, sono trattati successivamente i seguenti argomenti: —

1°. Resultanze tecniche e finanziarie dei primi tre anni di esperienze.

2°. Impianto industriale per lo sgranaggio del cotone. Lavorazione del seme e organizzazioni sussidiarie per il regolare svolgimento del lavoro.

3°. Risultanze tecniche e finanziarie dei successivi sette anni di colture cotoniere.

4°. Programma avvenire per lo sviluppo della coltura cotoniera, con l'intervento diretto del Governo.

Da questo breve studio emerge l'interessamento dato dagli industriali italiani allo sviluppo della coltura cotoniera e sopra tutto alla adattabilità della Colonia Eritrea a prestarsi ad un sensibile sviluppo della coltura stessa, contribuendo così agli sforzi che i vari centri europei fanno per emanciparsi dall' America.

[Translation.]

CULTIVATION OF COTTON IN THE COLONY OF ERITREA.

In order to form an idea of what has been done in Eritrea in relation to cotton cultivation, it is necessary to examine the work of the Society for the Cultivation of Cotton in Eritrea, because this Society was entrusted, if not officially, certainly semi-officially, with the task of a rational and systematic study of the said cultivation. In the memorandum submitted to the Congress the following points are therefore successively dealt with: —

(1) Technical and financial results of the first three years' experiments.

(2) Industrial installation for the ginning of cotton. Working of the seed and subsidiary arrangement for the regular progress of the work.

(3) Technical and financial results of the subsequent seven years of cotton cultivation.

(4) Future programme for the development of cotton cultivation with the direct intervention of the Government.

From this brief study may be seen the attention given by the Italian cotton manufacturers to the development of cotton cultivation and, in particular, to the suitability of Eritrea for a considerable development of the cultivation itself, thus contributing to the efforts which the various industrial European centres are making in order to emancipate themselves from America.

LA COLTIVAZIONE DEL COTONE E L'ALLEVAMENTO DEL BESTIAME NELLA SOMALIA ITALIANA MERIDIONALE.

Per Dott. Giuseppe Scasselatti.

[Abstract.]

L'autore, che ha recentemente esplorato la Somalia Italiana Meridionale per compiervi delle ricerche e studi agrari, dichiara che molte delle fertilissime regioni della colonia offrono le condizioni naturali più propizie per una estesa coltivazione del cotone. Però per le condizioni economiche attuali della Somalia occorre che si formino delle fortissime organizzazioni finanziarie, le quali, impiantando estese aziende a cotone, possano nello stesso tempo rimuovere le più gravi difficoltà che l'ambiente economico-agrario presenta.

Tra le questioni più importanti a risolvere per il miglioramento agrario della Somalia nelle presenti circostanze, l'autore propone quella della mano d'opera agraria occorrente, quella delle colture agrarie che potranno tentarsi con successo a fianco di quella del cotone e la necessità di una intesa anglo-italiana per la razionale utilizzazione agraria delle acque del fiume Giuba.

Uno dei problemi più interessanti per la Colonia Italiana bagnata dall'Oceano Indiano è anche l'allevamento del bestiame per la preparazione industriale della carne. Le condizioni dell'ambiente naturale ed economico sono favorevoli ad una tale impresa; l'autore, che si è occupato largamente della questione, detta norme generali per l'impianto della impressa zootecnica e di quella industriale relativa.

[TRANSLATION.]

GROWING OF COTTON AND RAISING OF CATTLE IN SOUTHERN ITALIAN SOMALILAND.

The writer, who has recently explored Southern Italian Somaliland for the purpose of carrying out researches and agrarian studies, declares that many of the fertile regions of the Colony offer most favourable natural conditions for an extensive cultivation of cotton. In view, however, of the present economic condition of Somaliland, it would be necessary for very strong financial organizations to be formed, which, by establishing extensive cotton plantations, may, at the same time, remove the most serious difficulties in the way of economic agrarian development.

Amongst the most important questions to be solved in connection with the agrarian improvement of Somaliland, as existing at present, the writer places that of the necessary agricultural labour, that of the agrarian crops which may be successfully tried, side by side with the cultivation of cotton and the necessity of an Anglo-Italian Entente with respect to the rational agrarian utilization of the waters of the Juba river.

One of the most interesting problems of the Italian Colony, whose shores are washed by the Indian Ocean, is also the raising of cattle for the supply of meat. The conditions of the natural and economic surroundings are favourable to such an undertaking; the writer, who has occupied himself very much with this question, gives general rules for the zootechnical and industrial aspects of this industry.

COTTON POSSIBILITIES IN ITALIAN SOMALILAND AND JUBALAND (BRITISH EAST AFRICA).

By Dr. R. ONOR,

Director of Agriculture for Italian Somaliland.

[No abstract supplied by the author.]

TUESDAY, JUNE 30.—MORNING SESSION,

11 A.M.

Section VII.—Miscellaneous Subjects.

Chairman: Professor P. Carmody, *Director of Agriculture, Trinidad.*

The Chairman: I have been asked to take the chair at this meeting, and I have much pleasure in calling upon Mr. Hewins to read his paper on the Economic Developments in the Anglo-Egyptian Sudan.

ECONOMIC DEVELOPMENTS IN THE ANGLO-EGYPTIAN SUDAN.

By H. P. Hewins,

Director, Commercial Intelligence Branch, Central Economic Board, Sudan Government, Khartoum.

[Abstract.]

The Anglo-Egyptian Sudan was conquered from the Dervishes, who had held it for some fourteen years, by a combined British and Egyptian force under Lord Kitchener in 1898.

The Dervishes had ruined the country. During their rule the population declined, owing to famine, warfare, and pestilence, from 8,000,000 to about 2,000,000.

The Sudan has made rapid recovery during the last fifteen years.

Revenue has increased from £E.127,000 in 1899 to £E.1,644,000 in 1913, and the country is now solvent.

External trade, which was practically non-existent at the time of the conquest, has now an annual value of nearly £E.4,000,000.

Practically the whole of the country now enjoys undisturbed tranquillity, and matters have so far progressed that the British Government has recently guaranteed the interest on a loan to

be contributed for £3,000,000 for irrigation schemes and railway extension.

This exceptional rate of progress is largely due to the fact that for the first time in its history the country is experiencing conditions under which economic development is possible, and that although the Dervishes decimated the population, there was little invested capital or organized industry to suffer from their destructive methods save a very crude and simple system of agriculture.

The progress which has been made may be divided shortly into three stages:—

1. The period of pacification.
2. Railway construction.
3. Economic expansion.

The last is distinguished mainly by the fact that means have become available for commencing an irrigation scheme for cotton growing in the Gezira.

Under this project some 500,000 acres or 780 square miles of land in the Gezira Plain lying between the White and Blue Niles, which meet at Khartoum, will be gradually brought under cultivation. In the future the area may be extended to 1,000,000 acres, and in time to come to some 3,000,000 acres.

Cotton has been grown in the Sudan for centuries, and the people are amenable to instruction in up-to-date methods of cultivation. This has been shown in the Tokar district in Red Sea Province, where excellent cotton has been grown for years past, and also at Tayiba in the Gezira, where a demonstration area, managed by the Sudan Plantations Syndicate on behalf of the Government, has given remarkable yields of Egyptian cotton grown by native tenant farmers.

Millions of acres of cotton land are available for future generations in other parts of the country.

There is a sufficient supply of labour for the gradual exploitation of the Gezira scheme. The population, also, is increasing rapidly, and is being further supplemented by immigration.

The semi-arab cultivator is proving much more efficient than was originally expected. His previous indifferent reputation was probably due partly to his lack of opportunity and the unsuitable conditions to which agriculture was subject. Uncertainty of results under an irregular rainfall tended to produce a slipshod cultivator.

Irrigation will help to remove some of these demoralizing influences, and great importance attaches to scientific investigations, such as will lay a firm foundation for successful cultivation under the improved conditions. The spread of vernacular education should have great influence in creating a sympathy between the cultivator and the pioneers of the more advanced principles.

Effect is being given to these conceptions, but affairs have necessarily reached only an elementary stage as yet.

The native has been assured an undisturbed possession of his land. Transport for his produce is provided by 1,500 miles of railway and some 2,500 miles of navigable waterway. A new harbour has been built at Port Sudan; the system of roads and wells is now extended, and motor traction is being introduced. Six thousand children are being educated in various schools. Slavery has been abolished.

Irrigation schemes are also being developed in Dongola Province for wheat growing, and in Tokar for the cultivation of cotton. Kassala offers good prospects for an irrigation project, both for cotton production and for cereals.

Cultivation by means of rainfall in districts where irrigation is impossible may be improved in course of time by instruction in methods of dry farming, but this must inevitably be a slow process.

The Sudan is not by any means a one-crop country. Its pastoral potentialities are very great, and a valuable export trade in cattle and sheep has already been established. The preparation of meat extract for export is likely to be taken up very soon, and should be followed by a frozen meat trade.

Other Sudan products for which there is a steady and increasing demand in Europe are oil seeds (*i.e.*, sesame, castor, ground nuts), wheat, barley, maize, sorghum, and tanning materials. The Sudan is already the largest producer of gum arabic, and it possesses an asset, likely to be of great value in the future, in its numerous fibre-producing plants. It is also a natural habitat of the ostrich, and breeding experiments have recently been commenced.

The country now appears to be well launched on a career of progress.

[Discussion.]

The Chairman: Gentlemen—We have listened to a most interesting and valuable paper. It is a paper which does not lend itself to discussion, but probably some of you may wish to get further information, and I am sure that Mr. Hewins will be very pleased to answer any questions addressed to him.

Captain Bennett Dampier: Mr. Chairman—Mr. Hewins told us at the end of his address of the very valuable uses of papyrus for paper making. I think it might be of interest to Mr. Hewins and to other gentlemen here to know that experiments have been made with regard to the use of papyrus for paper making, and, as a matter of fact, we shall have some two tons of papyrus from the Sudan in this country next month.

The CHAIRMAN: Before going on to the next paper, I think we should pass a very hearty vote of thanks to Mr. Hewins for the extremely interesting paper he has given us this morning.

PRESENTATION DES STATISTIQUES DU COMMERCE DES COLONIES FRANÇAISES, ANNEES 1907-1911.

Par CH. VERGNES,

Gouverneur des Colonies et Directeur de l'Office Colonial, Paris.

[No abstract supplied by the author.]

The CHAIRMAN: Would any gentleman like to raise any point in connection with M. Vergnes' paper? I may mention that the paper is accompanied by a number of tables and diagrams which will, I hope, be published, as they will add greatly to the interest of the paper. As there is no attempt at discussion, I will, on your behalf, offer a hearty vote of thanks to M. Vergnes for his kind contribution.

SOME NEW OR LITTLE KNOWN PHILIPPINE PRODUCTS.

By O. W. BARRETT,

Chief, Division of Horticulture, Bureau of Agriculture, Philippine Islands.

[ABSTRACT.]

A brief discussion of the geography, topography, climatic peculiarities, population, and agricultural status of the Philippines that prefaces an itemized list of the following:—

Philippine Forest Products: Statistics as to the exports and discussion of the principal items.

Palm Sugar: A discussion of the new Hines process for making high-grade sugar from various palm saps is given, and a brief discussion of the three principal palm species which may be important sugar producers in the near future.

Almáciga: The methods of obtaining this resin are discussed and statistics given.

Elemi: This resin is described and its production discussed.

Wood Oils: Statistics and botanical classification of the trees producing this new crop.

Dye Woods: Statistics given.

Tan Barks: Statistics given.

Rattan: A résumé of this industry with statistics.

Gutta-percha: Methods of collecting and statistics.

Rubber: The wild rubbers of the Philippines are described.
Pili Nuts: Statistics and discussion.
Lumbang: A résumé of this new Philippine industry is given.
St. Ignatius Beans: The origin of this crop is given.
Pearl Fisheries: Mother-of-pearl shell and the pearling industry of the Southern Islands is discussed.
Button Shells: Statistics.
Window Shells: Discussion.
Tortoiseshell: Statistics.
Trepang: Discussion of the industry.
Shark Fins: Statistics and discussion.
Edible Seaweed: Discussion of the principal species.
Isinglass: Discussion.
Sponges: Discussion.
Fish Ponds: Statistics.
Beeswax and Honey: Statistics and discussion.
Ambergris: Statistics.
Silk: Discussion.
Guano: Discussion.
Birds' Nests: Discussion.
Colugo Fur: Discussion.

[Discussion.]

M. Brenier (Indo-China): I have been much interested in Mr. Barrett's contribution, because I am very keenly interested in a country just opposite the Philippine Islands, that is to say, Indo-China. If I understood rightly, Mr. Barrett attaches extreme importance to the sugar palm, which he considers will come to the fore in a very short time. I should like to ask whether he really considers it as being a possible competitor against the sugar cane. What do you consider, Mr. Barrett, would be the comparative yield per acre of the sugar palm and the sugar cane?

Mr. Barrett: That is a difficult question to answer. When we come to statistics of yields per acre we always are rather cautious, but in the article on the subject in the May number of the *Philippine Agricultural Review* some estimates are given. Not having those figures at hand, I can only say that we calculate the yield per acre from the sugar palm to be about twice the present yield of sugar per acre from sugar cane with the ordinary cultivation. Taking the general average of the yield from sugar cane, I think I am warranted in saying that the sugar palm is giving a better yield of sugar from its much richer sap than the sugar cane, and without any expensive machinery. I know it is a very strong thing to say, but it is certainly going to be a very dangerous rival to the sugar cane when handled by modern methods.

The Chairman: Might I ask at what distance apart the palms are going to be planted?

Mr. Barrett: On a general average we put about 75 coconut palms to the acre, and we think the best distances for the sugar palm are from 60 to 80 or 100 per acre. As you know the leaves do not droop; they stand up.

M. Brenier: We have very large numbers of the sugar palm in certain parts of Indo-China, so that your communication is most interesting to us. Have you in mind the yield of sap per tree?

Mr. Barrett: From the trees which I myself worked at we got, so far as I remember, five to ten or eleven litres twice a day—that is, in the morning at six o'clock and in the evening at six o'clock. In the case of good trees, five to seven days after cutting, the yield may run to twelve or fifteen litres twice per day. The trees continue to yield for a period of two to three months.

M. Brenier: It may interest Mr. Barrett to know that we have tried several times to place palm sugar on the market without having met with any success. We have very large forests of the palms, and, especially at the Marseilles Exhibition of 1906, we had very large samples submitted to people who might be interested, but nothing came of it.

Mr. Barrett: I think there must have been something wrong there—either a prejudice against a new thing coming in, or that it was not properly advertised.

M. E. Leplae: This paper is highly interesting, and I should like to ask Mr. Barrett at what age these palms begin to flower.

Mr. Barrett: From the most trustworthy statements of the natives, I believe that the male flowers appear at four to six years.

M. E. Leplae: That is the same age as other palms, for example, the oil palms; but I suppose a good yield of sap is not obtained before nine or ten years?

Mr. Barrett: I think before nine years in the Philippines.

M. E. Leplae: Would you kindly tell us again the yield of sap from trees planted about 20 ft. square, say 75 per acre?

Mr. Barrett: A tree may yield during the year one, two, three, or even more male racemes, each one of which will give, say, ten litres of sap per day for a period of eight weeks.

M. E. Leplae: But many of them give twenty to thirty litres?

Mr. Barrett: Yes, for a short period of, say, two weeks.

M. E. Leplae: And that sap contains from 10 to 12 per cent. of sugar?

Mr. Barrett: No, 16 per cent., and in some cases 16½ per cent.; always about 15 per cent. without exception.

M. E. Leplae: I must congratulate the Chairman of this

Section. I believe the papers we have heard this morning are among the most interesting in the whole Congress.

The CHAIRMAN: Is there any other gentleman who would like to ask Mr. Barrett any further questions?

M. BRENIER: With reference to the silk, you told us that you obtained about nine broods per annum. May I ask if that is a regular production, because in Indo-China, although we get that, we do not consider it at all a normal production. We consider an average of six broods per annum a very large one. Nine broods is very exceptional.

Mr. BARRETT: So far as I know, it has gone on for a period of about four years now.

M. BRENIER: And these silkworms are from Bengal, if I remember rightly?

Mr. BARRETT: From Ceylon.

M. BRENIER: But they came from India really, I suppose, because I do not think that there is a regular silk culture in Ceylon; it has been introduced lately from British India—from Bengal, as far as I remember.

Mr. BARRETT: The silkworms came five or six years ago from Ceylon, and have been bred up until they get, if I am not mistaken, nine broods a year. The Philippinos are very pleased, and a great many companies are planting mulberries as rapidly as possible. The product brings a better price in the market than Chinese silk; it has exceeded all their most sanguine expectations.

M. BRENIER: You have no customs dues on silk?

Mr. BARRETT: I think there is a heavy duty.

M. BRENIER: That may explain why it is preferred to Chinese silk.

The CHAIRMAN: Well, gentlemen, this is a most interesting paper, and I should be very sorry to cut short any discussion of it, but time is passing, and there are other papers to be read. Before proceeding to those we will, I think, give Mr. Barrett our hearty thanks for a most interesting paper.

ELEPHANT DOMESTICATION IN THE BELGIAN CONGO.

By Captain LAPLUME,[1]

Director of the Elephant Training Station, Api (Uele).

[ABSTRACT.]

The Congo Government decided in 1899 to capture and to try to domesticate African elephants.

A training station was erected at Api in Uele (Northern

[1] Communicated by M. E. Leplae.

Congo) where elephants are particularly numerous. The organization of this station was carried out by Captain Laplume, the actual Director.

Captain Laplume captured his first elephants in 1900. In 1903 he had caught fifteen of these animals. He has now thirty-four. As the young captives became tamer, got older and taller, Captain Laplume started training them for agricultural work (carrying, cart-traction, ploughing).

The station now possesses sixteen elephants perfectly trained to this work. The training of the young elephants is not difficult. Some of the oldest animals are now put to regular work.

M. E. Leplae: As time is so short I will not read the paper, but will only make a few remarks to supplement the printed abstract.

The African elephant is just as easy to train as the Asiatic elephant. He is a very quiet and gentle animal, and it is not at all difficult to train him. We started in the Congo by capturing some young elephants by killing the mothers, and we have now thirty-four trained elephants, some of which are 7½ ft. high, and are supposed to be about 15 to 16 years old. They work very well, they carry packages on their backs, they pull wagons, they plough in the fields, they do anything you like. There is no difficulty at all in training them; the only difficulty is, of course, that if you have a big herd of elephants they eat every day a great quantity of forage. But that is not a serious difficulty, because, as soon as you start growing forage for them, you can give them as much as they want. Then, of course, very few places would need thirty elephants to work as a rule, and four or five on a farm, or perhaps ten, could do a lot of work. Up to the present our elephants have always been very gentle, and the men have never had any trouble with them. Once or twice we have lost some of them through stampeding, because they are in the back of the Congo forest, and they never see motor-cars or anything of that sort in those parts; there are, however, motor-cars in the vicinity, and we shall have to make a new station on the motor-car road and put the elephants there for a few months. They are so tame that in a few hours they get used to any noise. The first thing was to see whether the elephants could be tamed and trained. Now we have to see if these elephants can be put to an economic use—I mean whether they can stand hard work for a long time. At present they are working on a road and pulling a certain weight every day for so many miles; and after six months we shall know whether these elephants can be practically used. Then we are going to

give two of them to Lever Bros.' palm oil enterprise in the Congo, which is mostly worked by English capital. They are building roads and narrow-gauge railways, and even monorails, to carry bunches of palm fruits to their factories, and the carriage of these bunches is a very difficult thing in the centre of Africa, so they are going to try two of our elephants. The agreement with the Belgian Government is that Messrs. Lever get the two elephants free, but they are to obtain two Indian Mahouts from Ceylon for these elephants so that they shall be in good hands. That is the experiment we have now in hand, which may be interesting perhaps to the Sudan and some other places.

The CHAIRMAN: I think you will all agree with me that the communication made by M. Leplae is a very interesting one, and we thank him sincerely for letting us know about these African elephants. The information he has given may be useful in other parts of Africa.

SUR UNE MALADIE DU SAXAUL (*ARTHROPHYTON AMMODENDRON*).

Par BORIS DE FEDTSCHENKO,

Principal Botanist, Imperial Botanic Garden of Peter the Great, St. Petersburg.

[No abstract supplied by the author.]

THE CHAIRMAN: I will on your behalf give M. de Fedtschenko a very hearty vote of thanks for his communication, and I am sure those who wish to get further information on the subject will make the application which he suggests.

The following papers were taken as read:—

THE ECONOMIC RESOURCES OF BRITISH SOMALILAND.

By R. E. DRAKE-BROCKMAN, M.R.C.S.Eng., L.R.C.P.Lond.

[No abstract supplied by the author.]

THE ECONOMIC RESOURCES OF THE TERRITORIES OF THE COMPANHIA DO NYASSA.

By VINCENTE ALMEIDA D'ECA,

General Secretary of the Companhia do Nyassa.

[No abstract supplied by the author.]

MONOGRAPHIE DE LA SOCIETE DU MADAL, CHR. THAMS ET CIE.

Par Théophile Bonnet.

[No abstract supplied by the author.]

THE PROSPECTS OF DRY FARMING IN CEYLON.

By C. Drieberg, B.A., F.H.A.S.,

Secretary, Ceylon Agricultural Society, and Superintendent of Low-Country Products Division and School Gardens, Department of Agriculture, Ceylon.

[No abstract supplied by the author.]

THE PROGRESS OF NATIVE AGRICULTURE IN CEYLON.

By C. Drieberg, B.A., F.H.A.S.,

Secretary, Ceylon Agricultural Society, and Superintendent of Low-Country Products Division and School Gardens, Department of Agriculture, Ceylon.

[No abstract supplied by the author.]

L'ALTIPIANO DEL BENGUELLA IN RAPPORTO ALLO COLONIZZAZIONE BIANCA.

Per Professore Dino Taruffi.

[Abstract.]

L'altipiano di Benguella (Angola Portoghese) sta per essere attraversato, in tutta la sua lunghezza, dalla ferrovia che, partendo dalla costa alla Baia di Lobito, dovrà arrivare al Catanga.

Questa ferrovia già permette di raggiungere rapidamente l'altipiano, in cui mette in condizione di essere valorizzati dai quattro ai cinque milioni di ettari di terreno, ad una altitudine variabile dai 1,500 ai 1,800 o fino ai 2,000 metri.

I terreni che costituiscono questa zona altoplanica provengono dal disfacimento di rocce arcaiche, in grandissima prevalenza del granito; presentano predominanza di sabbia e sostenze sabbiformi, essendo abbastanza provvisti di sostanze colloidi; sono ricchi di potassa, di anidride fosforica e mediocremente di azoto; difettano di calcare, che invece è abbondantissimo nella formazione della zona prealtoplanica.

Sono pianeggianti o con lievi inclinazioni, profondi e quindi

di facile lavorazione, permettendo l'uso anche di potenti mezzi aratori.

Secondo le ricerche fatte (purtroppo saltuarimente), su questo altopiano cade annualmente una quantità di acqua considerata di mm. 1,300 a mm. 1,700, distribuita nel periodo di settembre ad aprile, con una leggera sosta in gennaio ed accompagnata da temperature massime diurne intorno ai 30-32° e notturne intorno ai 16-18° C. Il rimanente periodo dell'anno è asciutto con temperature diurne 24-26° e notturne 4-6° C.

L'abbondante caduta di acque nei terreni facilmente permeabili che, specialmente nelle parti più rilevate costituiscono questo altopiano, determina un abbondante stillicidio sui fianchi delle valli e nei torrentelli che solcano con frequenza l'altopiano stesso, fornendolo perennemente di acqua, utilizzabili anche per modeste ma numerose opere irrigatorie. La popolazione indigena che permanentemente lo abita, vi coltiva mais, fagiuoli, patate, patata dolce; i commercianti portoghesi hanno introdotto nei loro orti, agrumi, nespoli, peschi e frutti diversi. Vi sono allevati bovini, ovini, suini, volatili da cortile.

Vi è grande disponibilità di terre demaniali essendo limitatissima in estensione la terra coltivata dagli indigeni, che fino ad oggi si sono dedicati specialmente al commercio ed al trasporto, dalle regioni interne verso la costa, di caucciù ed altro.

Esistono quindi nel complesso sull'altopiano di Benguella condizioni favorevoli, tanto per una agricoltura a tipo industriale condotta da coltivatori bianchi ed eseguita da mano d'opera indigena; come per una colonizzazione fatta direttamente mediante coltivatori bianchi.

[Translation.]

THE TABLE-LAND OF BENGUELA IN RELATION TO COLONIZATION BY WHITES.

The table-land of Benguela (Portuguese Angola) is about to be crossed over its entire extent by the railway, which, starting from the Bay of Lobito, will terminate at Katanga.

This railway already makes it possible to reach the table-land speedily, thus making available for cultivation an area of from 4,000,000 to 5,000,000 hectares of land at a height varying from 1,500 to 1,800 or even up to 2,000 metres.

The soil which constitutes this zone of table-land has been formed by the destruction of primitive rocks, in which granite

very largely predominates; it shows a preponderance of sand and sand-like substances and has a sufficient content of colloidal substances; it is rich in potash, phosphoric acid, and moderately so in nitrogen; it is deficient in lime, which occurs, however, in abundance in the formation of the pre-plateau zone.

The land is nearly level with only slight declivities; it has a deep soil and is consequently easy to work, the use of powerful agricultural machinery being possible.

According to the researches carried out (unfortunately only by fits and starts) on this table-land, there is an annual rainfall of about 1,300 to 1,700 mm. distributed over the period from September to April, with a slight break in January, and accompanied by maximum day temperatures of about 30-32° and night temperatures of from 16-18° C. During the remainder of the year there is no rain and the temperature during the day is from 24-26° and during the nights from 4-6° C.

The abundant rainfall on these lands which are easily permeated, especially in the higher portions constituting the table-land, causes an abundant percolation on the sides of the valleys and in the streams which frequently cut through the table-land itself, thus giving a constant supply of water which can be utilized for small but numerous irrigation works. The native population, which permanently inhabits this table-land, cultivates maize, beans, potatoes, and sweet potatoes; the Portuguese merchants have introduced into their orchards oranges and lemons, medlars, peaches, and several other fruit trees. Large quantities of cattle, sheep, pigs, and poultry are reared.

There is plenty of good domanial land available, as the area cultivated by natives is very limited in extent in consequence of the latter having devoted themselves, up to the present, chiefly to the trade in and the conveyance of rubber, etc., from the internal districts to the coast.

There consequently exist, all over the table-land of Benguela, favourable conditions, not only for agriculture of the industrial type, conducted by whites as cultivators, and carried out by native labour, but also for a colonization carried out directly by white farmers.

LA GUINEE PORTUGAISE.

Par Carlos Pereira,

Ancien Gouverneur de la Guinée.

[No abstract supplied by the author.]

LA TERRE, LE CAPITAL ET LE TRAVAIL DANS L'INDE PORTUGAISE.

Par Dr. Caetano Gonçalves,

Ancien Gouverneur aux Colonies.

[Abstract.]

Le territoire portugais dans l'Inde comprend 3,806 kilomètres dont un tiers à peine est régulièrement cultivé de riz et de cocotiers, celui-là insuffisant à la consommation locale, et insuffisants tous les deux à maintenir l'équilibre économique de la Colonie, puisque les autres cultures sont peu importantes, et l'émigration calculée en 60 pour mille par an, est dûe à l'excès de la population sur la production. Ainsi, sur une population de 530,000 habitants, en 1909-10, l'importation de riz a été de 1,200,000 lb., et l'exportation ne dépasse pas 800,000 lb., ce qui représente un déficit de 400,000 lb.

Toutefois, les services agricoles sont l'objet de tous les égards du gouvernement de la Colonie, et à la charge d'une inspection d'agriculture et d'un bureau d'agrimesure.

On attend que l'amélioration dans la préparation des terrains par des travaux irrigatoires en partie déjà réalisés, facilitent une plus grande variété et une plus grande étendue dans les cultures, protégées par des capitaux, qui n'abondent pas dans le pays, et ne pourraient avoir de meilleur emploi.

Le besoin d'une Caisse de Crédit Agricole s'impose, quoique de petites institutions similaires s'acquittent autant que possible des services qui leur sont demandés.

Il n'y a pas de régime de travail compulsoire, et il est très dispensable, puisque l'offre de la main d'œuvre est bien supérieure à la recherche, et ce n'est que dernièrement, que par l'émigration, elle est devenue moins abondante. La moitié de la population locale s'adonne à l'agriculture et à l'industrie, et celle-ci comprend l'extraction du sel, du mineral, la fabrication de tissus, de conserves, et d'eaux de vie.

L'indigène est sobre dans la nourriture et la boisson. Cependant, il paraît que l'alcoolisme tend à se développer, surtout dans les couches inférieures de la population chrétienne. L'hindou et le musulman par précepte religieux s'abstiennent d'alcool.

Les institutions d'assistance n'y existent pas, ainsi que la protection au travailleur indigène. A peine, par un décret de Août de 1901, on a règlementé les rapports des propriétaires avec leurs colons, ou travailleurs, résidant dans l'aire des propriétés rustiques. Le travail pénal n'y existe, pas plus que le militaire, puisque l'enrôlement est volontaire.

[TRANSLATION.]

LAND, CAPITAL AND LABOUR IN PORTUGUESE INDIA.

The Portuguese territory in India comprises 3,806 kilometres, of which barely a third is regularly cultivated in rice and coconut palms, the former being insufficient for local consumption, and both insufficient to maintain the economic equilibrium of the Colony. Other crops are of little importance, and emigration, calculated at 60 per 1,000 per annum, is the result of the excess of population over production. Thus, with a population of 530,000 inhabitants in 1909-10, the imports of rice were 1,200,000 lb. and the exports did not exceed 800,000 lb., representing a deficit of 400,000 lb.

However, the agricultural services receive the greatest consideration from the Government of the Colony, and are in charge of an Inspector of Agriculture and a Bureau of Land Survey.

It is expected that the improvement in the preparation of the land by irrigation works, already partly realized, will facilitate a larger variety and a greater extent in the crops cultivated and protected by capital, which is not abundant in the country, though it could not be employed to better purpose.

The need of an Agricultural Credit Bank is increasing, though small similar institutions fulfil, as far as possible, the services demanded of them.

There is no compulsory labour, such a system being quite unnecessary, as the supply of labour is far in excess of the demand, and it is only recently that owing to emigration it has become less abundant. Half the local population is engaged in agriculture and industry, the latter including the extraction of salt and minerals, and the manufacture of woven fabrics, preserves, and spirits.

The native is temperate in eating and drinking. It appears, however, that alcoholism tends to increase, especially in the lower ranks of the Christian population. The Hindus and Mussulmans, in accordance with their religious precepts, abstain from alcohol.

Poor-law institutions do not exist, neither is there protection of native labour. Recently, by a decree of August, 1901, the relations of landowners with their colonists or labourers residing in the area of country estates have been regulated. Penal labour does not exist. Enrolment in the military forces is voluntary.

LA MAIN D'ŒUVRE AUX ILES DE CABO VERDE.

Par Franciso de Paula Cid,

Ancien Gouverneur aux Colonies.

[Abstract.]

Dans ce mémoire l'auteur s'occupe des sujets qui suivent : —

La découverte des îles—ses premiers colons—son climat et sa production.

Centres de production agricole, et de production industrielle sous le point de vue de la main d'œuvre.

Conditions de vie des travailleurs.

Les travailleurs considérés sous le point de vue de la production.

Occupation des terrains par les travailleurs.

Institutions pour faciliter la production et protéger les travailleurs.

Contrats.

Système de rémunération du travail dans l'agriculture et dans l'industrie.—Salaires et participation aux bénéfices.—Taxe des salaires.—Le sexe et l'âge des travailleurs.—Emploi des salaires par les travailleurs.

Quels sont les centres habités, qui produisent des travailleurs. —Le contrat et la dislocation des travailleurs peut nuire à l'agriculture ou au développement de la population ou à la vie sociale des localités ou on va les prendre.—Conditions de transport.

Main d'œuvre employée par le Gouvernement.—Service militaire.—Travail des prisonniers pour crimes de droit commun.

Emigration.—Pour l'étranger et pour les colonies portugaises.—Principaux métiers où ils employent leur activité aux pays étrangers.

[Translation.]

LABOUR IN THE CAPE VERDE ISLANDS.

In this paper the author deals with the following subjects : —

The discovery of the islands—its first colonists—its climate and its production.

Centres of agricultural production, and industrial production from the point of view of labour.

Conditions of life for labourers.

Labourers considered from the point of view of production.

Occupation of the soil by the labourers.

Institutions for facilitating production and protecting the labourers.

Contracts.

System of remuneration of labour in agriculture and industry. Wages and participation in profits. Taxation of wages. Sex and age of labourers. Use of their wages by labourers.

The inhabited centres which provide the labourers. Contract labour and the dislocation of labourers may injure agriculture or the development of the population or the social life of the localities whence they are taken. Conditions of transport.

Labour employed by the Government. Military service. Labour of prisoners for crimes against common law.

Emigration.—Abroad and to the Portuguese Colonies. Principal trades in which their activities are employed in foreign countries.

ORGANISATION ET RECRUTEMENT DE LA MAIN D'ŒUVRE DANS LA PROVINCE DE ST. THOME ET PRINCE.

Par José Joaquim Xavia de Brito,

Ancien Gouverneur de la Province de St. Thomé et Prince.

[No abstract supplied by the author.]

LA MAIN DŒ'UVRE INDIGENE A ANGOLA.

Par J. A. Alves Roçadas,

Ancien Gouverneur Général de la Colonie.

[No abstract supplied by the author.]

ORGANISATION DU TRAVAIL ET FOURNISSEMENT DE LA MAIN D'ŒUVRE DANS LA COLONIE PORTUGAISE DE TIMOR.

Par Jayme Augusto Vieira da Rocha,

Ancien Gouverneur de Timor.

[No abstract supplied by the author.]

A SHORT REVIEW OF THE LABOUR CONDITIONS AND THE PROVISION OF LABOUR ON AGRICULTURAL, MINING AND OTHER ESTATES IN THE NETHERLAND EAST INDIES.

By P. A. Moorrees.

[No abstract supplied by the author.]

SGUARDO COMPARATIVO SULLE CONCESSIONI DELLA TERRA NELLA COLONIZZAZIONE.

Per Professore DINO TARUFFI.

[ABSTRACT.]

L'eccesso di popolazione nei paesi vecchi è quella che spinge il proletariato verso i paesi nuovi per colonizzarne le terre.

Questo eccesso può essere *assoluto* o *relativo*. Assoluto, quando nelle terre metropolitane l'intensivazione delle colture ha raggiunto il massimo consentito; relativo, quando dipende da mancante intensificazione dei sistemi di coltura.

Nel secondo supposito, l'emigrazione dai paesi vecchi provoca in essi lo svalutamento delle terre, e questo fatto successivamente è sprone verso la colonizzazione: in tal modo l'emigrazione verso i paesi nuovi, che determina in questi la messa in valore dei terreni, spinge successivamente verso la colonizzazione anche nei paesi vecchi.

Nei paesi nuovi, l'esistenza di abbondanti riserve demaniali facilita la colonizzazione bianca; mentre nei paesi europei, la esistenza di una larga proprietà privata, fa mancare le terre disponibili alla coltura.

Nel primo caso, le concessioni gratuite o quasi gratuite sono possibili e, di preferenza fatte, servono da richiamo dei lavoratori della terra; le norme cui vengono subordinate tali concessioni, cercano di garantire i fini della colonizzazione. Nei paesi vecchi, in difetto di terre, il miglior sistema appare una sapiente organizzazione di credito, che permetta ai coltivatori di acquistare le terre, pagando del proprio solo una parte minima del prezzo e lasciando ai coltivatori stessi tutta la responsabilità tecnica o finanziaria dell'impresa che assumono.

In mezzo ai due termini che abbiamo esaminato un altro ne esiste rappresentato dai paesi di conquista in cui i popoli colonizzatori trovano una civiltà ed un regime fondiario (Algeria, Tunisia, Libia) che non si possono trascurare e che tolgono la disponibilità di molta parte delle terre, quasi come accade nei paesi metropolitani; in questo caso il miglior sistema apparisce quello di liberare le terre da tutti i diritti affrancabili che le gravano, e facilitarne la circolazione, seguendo concetti analoghi a quelli che predominano nei paesi vecchi. L'impresa in questo caso apparisce la più delicata per la difficoltà di ben comprendere e determinare il regime fondiario del paese conquistato.

Costituita la proprietà coltivatrice, due ulteriori condizioni si rendono indispensabili per mantenerla vitale, tanto nei paesi vecchi che nuovi: una buona organizzazione di credito

agricolo, ed una buona preparazione tecnica dei coltivatori: altri mezzi artificiali per conservare la proprietà coltivatrice si dimostrano meno efficaci.

[Translation.]

COMPARATIVE REVIEW OF LAND CONCESSIONS IN COLONIZATION.

The excess of population in the old countries is the force which drives the proletariat towards new countries with a view to colonizing the land.

This excess may be either *absolute* or *relative*. It is *absolute* when, in the home country, the intensity of cultivation has reached its possible maximum, and *relative* when it depends on insufficient intensity in the systems of cultivation.

In the second case, emigration from old countries produces in the same a depreciation in the value of the land, and this fact gives subsequently an impetus to colonization; in this manner emigration into new countries, which determines in the latter the cultivation of the land, may subsequently give an impetus to colonization also in the old countries.

In new countries the existence of large Government reservations facilitates colonization by whites, while in European countries the existence of large private properties causes a deficiency in land available for cultivation.

In the former case gratuitous or quasi-gratuitous concessions are possible and are preferably so granted; they serve as an inducement to workers of the soil; by the conditions to which these concessions are subject it is intended to guarantee the final object of colonization. In the old countries, where there is a deficiency in land, the best system appears to be a prudent organization of credit which enables the farmers to acquire the land by paying out of their own means only a minimum portion of the price while at the same time leaving to them the entire technical and financial responsibility of their undertaking.

Between the two extremes of which we have just spoken there exists another position, represented by conquered countries, in which the colonizing population finds already a civilization and a landed-property system (as in Algeria, Tunis, Libya) which cannot be put aside and by which a great part of the land is deprived of its available character in a nearly similar way as in the home countries; in such a case the best system would appear to be that of freeing the land from all redeemable rights weighing on it and facilitating its sale and purchase in accordance with the ideas prevailing in the old countries. In such a case the undertaking appears to

be the more delicate one by reason of the difficulty of understanding and determining exactly the landed-property system of the conquered country.

After the suitability of the land for cultivation has been established, there are two further indispensable conditions for maintaining its value, in old as well as in new countries—good organization of agricultural credit and good technical instruction of the farmers; other artificial means for preserving the agricultural capacity of the land have been shown to be less efficient.

NOTE ON THE MANGROVE FORESTS OF BRITISH INDIA.

By R. S. Pearson, F.L.S.,

Economist, Forest Research Institute, Dehra Dun, India.

[Abstract.]

Up to the present no mangrove bark has been exported from India to Europe, though considerable quantities are used in India itself, being imported into Calcutta and into Rangoon and Moulmein from the coastal forests of Bassein, Tavoy, and Mergui.

The most important mangroves commercially are *Rhizophora mucronata*, Lamk.; *R. conjugata*, Linn.; *Ceriops Candolleana*, Arn.; *C. Roxburghiana*, Arn.; *Kandelia Rheedii*, W. and A.; and *Bruguiera gymnorrhiza*, Lamk.; and the distribution of these species in India and elsewhere is described.

In India the most important mangrove forests occur on the Arakan and South Tenasserim coasts, the Sunderbans, the Andaman Isles, and to a less extent the Bassein coast of Burma. The economic possibilities of each of these areas as sources of supply of mangrove bark for the manufacture of extract locally are discussed.

Arakan and Mergui are regarded as the two most promising areas for the preparation of tanning extracts from mangrove bark in India. It is considered that on a forty-year felling rotation, 30,000 tons of green bark could be produced annually in Arakan. The best site for a factory in this area will be either Sandoway or Kyaukpyu, and it is estimated that the total cost of bark delivered there will be Rs. 12-15 per ton. In Mergui it has been found that bark can be collected and delivered in Rangoon at a cost of Rs. 16.6.6. per ton.

A short bibliography of the literature of the chemical examination of Indian mangrove barks and of experiments on the preparation of extracts from them is also given.

COFFEE-LEAF DISEASE (*HEMILEIA VASTATRIX*, B. ET BR.) IN UGANDA.

By S. Simpson, B.Sc.,
Director of Agriculture, Uganda.

WITH A NOTE ON THE PRESENT POSITION

By W. Small, M.A., B.Sc.,
Botanist to the Department.

[Abstract.]

Coffee may be said to be indigenous to Uganda, as the early explorers mentioned its existence and large numbers of coffee trees (*Coffea robusta*, Lind.) are scattered throughout the Buganda Province.

There can be no doubt that coffee-leaf disease has been present in the country for many years, but was thought to be something else.

Later work on the subject has been done, and the examination of a large number of type specimens undertaken, so that the fact is now established that there is no record of coffee being attacked by any species of *Hemileia* other than *H. vastatrix.*

The treatment undertaken was picking and burning the leaves and spraying plants with Bordeaux and Burgundy mixtures.

So far spores of *Hemileia* from leaves of *Coffea robusta* Lind. have failed to infect leaves of cultivated coffee.

Transport of *Hemileia* spores is easily accomplished by natural agencies such as the wind, but largely by the labourers. The drier weather of 1913 arrested the progress of the disease, and many estates which were severely ravaged are now showing masses of fresh new foliage, new shoots, and prospects of good crops.

Again, the disease being endemic cannot be expected to work the havoc that it wrought in Ceylon.

Experiments with sulphur and lime as powders and various solutions of salt and lime used as a spray have been disappointing. Up to the present Bordeaux and Burgundy mixtures have given the best results.

The behaviour of *Hemileia* is essentially that recorded from other parts.

A search has been made for a possible *Aecidium* condition, without result.

At least ten genera of the Rubiaceæ occur in the Victoria

Nyanza region, and four of these harbour species of *Hemileia* in other parts.

Speaking generally, the present outlook is favourable to coffee planters in Uganda, and planters are now realizing that preventive measures must be taken against *Hemeleia vastatrix*.

RELAZIONE SUGLI STUDI PER LA COLTIVAZIONE DEL CAFFE NELLA REGIONE DI FILFIL.

Per Comm. Professore Isaia Baldrati,

Direttore di Colonizzazione, Asmara (Eritrea).

[Abstract.]

(*a*) Precedenti tentativi e giudizi di viaggiatori e naturalisti sulla regione;

(*b*) Il clima della regione;

(*c*) Risultati delle esperienze fatte dal 1903 a tutt'oggi;

(*d*) Norme fondamentali di coltura in rapporto alle particolari condizioni d'ambiente;

(*e*) Le coltivazioni private di caffè fino ad oggi iniziate;

(*f*) Provvedimenti necessari per il desiderabile incremento.

[Translation.]

AN ACCOUNT OF THE CULTIVATION OF COFFEE IN THE FILFIL DISTRICT.

This paper deals with the following subjects: Former experiments and opinions of travellers and naturalists. Climate. Results of experiments made from 1903 to the present time. Normal rules for cultivation considered with regard to the special conditions of the area. Present condition of the cultivation of coffee. Precautions to be observed in future development.

CONSIDERATIONS PRATIQUES SUR LA PRODUCTION, LA PRESENTATION ET LE COMMERCE DU THE.

Par M. A. Berteau.

[No abstract supplied by the author.]

FRUIT CULTURE IN THE TROPICS.

By H. F. Macmillan, F.L.S.,

Superintendent, Botanic Gardens, Ceylon.

[No abstract supplied by the author.]

LA SITUATION ET L'AVENIR DE LA VITICULTURE DANS L'AFRIQUE DU NORD.

Par M. Marsais,

Chef de Travaux à l'Institut National Agronomique.

[Abstract.]

L'auteur donne les chiffres des dernières statistiques qui montrent que la production vinicole est en pleine prospérité, notamment dans les trois départements algériens; il faut prévoir que d'ici peu la production de l'Algérie dépassera 10 millions d'hectolitres par an.

La reconstitution en vignes greffées sur plants américains est activement poussée; les porte-greffes employés sont bien adaptés au sol et au climat; ils assurent une récolte abondante. La situation privilégiée de l'Afrique du Nord s'affirme depuis quelques années défavorables à la viticulture metropolitaine; les maladies cryptogamiques y sont rares, ou plus faciles à combattre. Les altises, le mildiou et surtout les vents desséchants, le sirocco, sont les ennemis les plus redoutés.

Les cépages employés sont ceux du Midi de la France: Carignan, Mourvédre, Petits Bouschet, Aramon, Clairette et Cuisant; les raisins de table (Chasselas) sont cultivés sur le littoral et font l'objet d'un commerce important.

L'avenir de cette culture dans l'Afrique du Nord semble superbe, au point de vue cultural. Au point de vue economique, si les frais de production sont très sensiblement inférieurs à ceux qu'il faut faire dans la métropole, la situation pourrait néanmoins devenir critique si les plantations nouvelles se développaient inconsidérément; en tous cas, la viticulture métropolitaine en subirait les conséquences la première. L'auteur tire cette conclusion de l'étude detaillée du vignoble tunisien, du vignoble algérien et du vignoble marocain, envoie de création, en donnant pour chacun les chiffres des productions, des surfaces complantées en vignes et en décrivant les types de vins produits.

[Translation.]

POSITION AND FUTURE OF VITICULTURE IN NORTHERN AFRICA

The author gives the figures of the latest statistics, which show that wine production is fully prosperous, notably in the
Algeria's production will exceed ten million hectolitres a year.
three Algerian Departments. He foresees that very shortly

The reconstitution of the vineyards by vines grafted on American plants is actively pursued; the stocks employed for grafting are well adapted to the soil and climate, and assure an abundant yield. The privileged position of Northern Africa has been asserting itself for some years past, which have been unfavourable for viticulture in the home country; cryptogamic diseases are rare there or more easily contended with. Vine beetles (altises), mildew, and especially the drying wind, the sirocco, are the most serious enemies.

The vine-stocks employed are those of the south of France: Carignan, Mourvédre, Petits Bouschet, Aramon, Clairette and Cuisant; table grapes (Chasselas) are cultivated on the coast and are the subject of an important trade.

The future of this industry in Northern Africa seems superb from the point of view of cultivation. From the economic point of view, if the cost of production is very appreciably less than in the home country, the situation might nevertheless become critical if new plantations were developed thoughtlessly; in any case, home viticulture would suffer the consequences first. The author draws this conclusion from his detailed study of Tunisian, Algerian and Moroccan wine-growing, giving for each country the figures of production, area planted with vines, and describing the types of wines produced.

TEFF, A VALUABLE TROPICAL AND SUB-TROPICAL HAY CROP.

By Joseph Burtt-Davy, F.L.S., F.R.G.S.

Owing to the remarkable success which has attended the introduction of teff (*Eragrostis abyssinica*) into South Africa, it is highly desirable that the value of this grass should be brought to the notice of the members of the Congress.

Teff is an annual hay grass, particularly suitable for use as a summer catch-crop, and a smother-crop for weeds, owing to its rapid growth when weather conditions are at all favourable. It gives a heavy yield of hay of exceedingly fine quality and high nutritive value, more nearly resembling English meadow hay than any other hay grass grown in South Africa. If sown with the early spring rains, the writer has been able to cut three crops of hay in the season, giving 2½ to 3 tons per acre, and to obtain autumn grazing from the aftermath.

The introduction of teff grass into South Africa has raised many small farmers struggling for a living to positions of comparative comfort and independence. Our farmers are unanimously agreed that this introduction alone has repaid

over and over again the whole cost of the Division of Botany of the Department of Agriculture from its inception to date.

The writer has made arrangements with Messrs. Sutton and Sons, of Reading, England, to supply for experiment 5 lb. of seed to any member who applies to them, at practically cost price.

CONTRIBUTION POUR L'ETUDE DES HERBAGES D'ANGOLA.

Par JOAQUIM PRATAS,

Médecin Vétérinaire, Préparateur de Chimie à l'Institut Supérieur d'Agronomie de Lisbonne.

[ABSTRACT.]

L'auteur présente ce travail, comme le principe d'une série d'études sur la nourriture des animaux dans les colonies portugaises, qu'il se propose de faire dans les laboratoires de l'Institut Supérieur d'Agronomie de Lisbonne.

Il commence par faire la définition du mot régional *capim* (*foin*). Il considère ce fourrage comme la base de la nourriture du bétail à Angola. Ensuite il ébauche l'état encore rudimentaire des exploitations zootechniques dans cette Province, faisant comprendre qu'elles constitueront une source de richesse publique incontestable, lorsque le colon leur prêtera ses soins les plus dévoués.

Considérant que le principe de quelque exploitation de ce genre doit commencer par la production de bons fourrages, qui constituent la matière première, a être transformée par la machine animale, il condamne l'habitude d'abandonner les animaux indigènes au pâturage dans les prairies naturelles, sans que, jusqu'au moment actuel, on ait essayé l'établissement de prairies artificelles. Il étudie ensuite trois échantillons de foin (*capim*) de différentes localités d'Angola.

Il fait précéder cette étude de quelques considérations générales, sur la diversité des climats et de la flore.

Il tâche d'essayer l'étude botanique des échantillons envoyés, dans lesquels il parvient à faire la classification de quelques plantes, et ensuite d'après l'opinion de plusieurs auteurs (à défaut de flore régionale) il prévoit la composition botanique des fourrages spontanés.

Il fait encore l'appréciation des échantillons en question, en commençant par l'étude macroscopique sommaire, dans laquelle il employe le procès de pointage de Dechambre.

Après quoi, il fait son étude chimique, en comparant sa richesse avec celle des foins portugais et étrangers.

[TRANSLATION.]

CONTRIBUTION TO THE STUDY OF THE GRASSES OF ANGOLA.

The author presents this work as the first of a series of studies on the feeding of animals in the Portuguese Colonies, which he proposes to make in the laboratories of the Higher Institute of Agriculture at Lisbon.

He begins by defining the local word *capim* (hay), and considers this fodder as the basis for the feeding of cattle in Angola. Then he sketches the still rudimentary state of zootechnical exploitation in this Province, and maintains that it will constitute an incontestable source of public wealth if the colonists will give their best attention to it.

Considering that the first step in any exploitation of this kind should aim at the production of good fodder, which constitutes the raw material to be transformed by the animal machine, he condemns the custom of abandoning the native animals to the pasturage of the natural prairies without making any attempt up to the present to establish artificial pastures. He then studies three samples of hay (*capim*) from different localities in Angola.

He precedes this study with some general considerations on the diversity of the climate and flora. He attempts the botanical study of the samples sent, in which he succeeds in classifying some plants, and then on the basis of the opinion of several authors (in the absence of local flora) he forecasts the botanical composition of the natural fodders.

He then examines the value of the samples in question, beginning with a brief macroscopic study, in which he employs Dechambre's method of "points." After this he describes his chemical examination, comparing the quality with that of Portuguese and foreign hays.

DELL' USO DELL' ACIDO CLORIDRICO O DI ALTRE SOSTANZE ACIDE MINERALI E DI SOSTANZE SPECIALI PER LA CONSERVAZIONE E BUONA MATURAZIONE DEI FORAGGI IN SILO, NEI CLIMI CALDI.

Per Professore ITALO GIGLIOLI.

[ABSTRACT.]

Si espone la particolare importanza dell'insilamento nei paesi caldi, per utilizzare i foraggi e le piante pabulari spontanee, durante la stagione piovosa e serbarle allo stato succo-

lento par la stagione più arida e calda. Si notano le grandi e variabili perdite che può subire la sostanza secca del foraggio conservato in silo. Tali perdite di sostanza nutriente si accentuano nei paesi caldi. Quindi la necessità, in questi climi, più che nei temperati, di aiutare batteriologicamente o chimicamente la buona conservazione del foraggio nel silo. Si passano in rivista vari metodi sperimentali o da sperimentare: la scottatura col vapore: la inoculazione con fermenti lattici: l'aggiunta di melasse: il trattamento con solfuro di carbonio o con anidride solforosa: il trattamento con acidi minerali, specialmente con l'acido cloridrico.

Si preferiscono i metodi chimici a quello dell'inacidimento con fermenti lattici selezionati. Si suggeriscono nuovi concetti in riguardo all'insilato melassato. Si insiste sulla utilità di prove nuove col solfuro di carbonio, col tetracloruro di carbonio e coll'anidride solforosa. Si riassume la storia della sperimentazione finora fatta, medicando l'insilato con acidi e sostanze acide. Si richiama in special modo l'attenzione degli studiosi di agricoltura coloniale a sperimenti sull'uso nell'insilamento dell'acido cloridrico. Segue la bibliografia degli argomenti trattati.

[Translation.]

ON THE APPLICATION OF HYDROCHLORIC ACID OR OF OTHER ACID MINERAL SUBSTANCES AND OF SPECIAL SUBSTANCES TO ENSILAGE, FOR ENSURING THE CONSERVATION AND RIPENING OF SUCCULENT FORAGE IN WARM CLIMATES.

The author draws attention to the special importance of ensilage in warm climates. By this practice green crops and herbage and other green vegetable products can be gathered during the rainy season and preserved as succulent forage for the dry and hot months. Forage stored in silos is inevitably liable to great and variable losses of dry substance, and these losses in the nutritive value of the forage are naturally greater in warm climates. Hence the need in these, more than in temperate climates, of artificially assisting the preservation of ensilage, either by bacteriological or chemical means. Several methods, already applied or proposed, are passed in review: steaming; inoculation with lactic ferments; addition of molasses; treatment with carbon disulphide or with sulphur dioxide; treatment with mineral acid, especially with hydrochloric acid.

Preference is given to chemical methods rather than to

inoculation with lactic ferments. New suggestions are made with regard to ensilage treated with molasses.

The need of new experiments is urged in regard to treatment with carbon disulphide, with carbon tetrachloride, and with sulphur dioxide.

A historical summary is given of the experiments on the treatment of ensilage with acids or acid salts. Special attention is called to the need of new experiments in the application of hydrochloric acid to ensilage.

A bibliography is appended.

EMPLOI DE LA FARINE DE MANIOC DANS L'ALIMENTATION DES VACHES LAITIERES.

Par J. E. Lucas.

[Abstract.]

Les aliments concentrés ont ces années dernières augmenté considérablement de prix. Aussi est-il intéressant de rechercher, par tous les moyens, à fournir aux animaux une alimentation aussi nutritive mais beaucoup moins coûteuse, en utilisant tous les produits nouveaux que peuvent fournir nos récoltes coloniales.

La substitution d'un mélange de farine de manioc (60 pour cent) et de tourteau d'arachide (40 pour cent) a permis de remplacer un poids égal de tourteau de gluten de maïs.

L'expérience qui a été faite sur deux lots de vaches dont l'un est resté témoin a permis de montrer l'efficacité de cette substitution qui permettait au moment de l'expérience de réaliser une économie de 4·25 par 100 kilo de marchandise employée.

Il s'agit pour une vacherie de 100 bêtes de 3,000 francs d'économie par an.

[Translation.]

USE OF MANIOC FLOUR IN THE FEEDING OF MILCH COWS.

Concentrated foods have considerably increased in price in recent years. It is therefore of interest to endeavour by every means to supply for animals a feeding sfuff as nutritious but much less costly, by utilizing every new product which our Colonial crops are able to furnish.

The substitution of a mixture of manioc flour (60 per cent.) and ground nut cake (40 per cent.) has rendered it possible to replace an equal weight of maize gluten cake.

The experiment, which has been made with two lots of cows, one of which was kept as a check, has enabled the efficacy of this substitution to be demonstrated. At the time of the experiment a saving of 4·25 per 100 kilograms of material employed was effected.

This would represent a saving of 3,000 francs a year for a herd of 100 cows.

LA TOURTEAU D'ARACHIDE DANS L'ALIMENTATION DU CHEVAL.

Par J. E. Lucas.

[Abstract.]

Les fourrages étant très chers à Paris, l'auteur a tenté de leur substituer une alimentation différente.

Il a utilisé à ce propos la paille, la tourbe mélassée et le tourteau d'arachide. Il obtient ainsi une alimentation contenant les mêmes éléments que les foins et a pu entretenir en parfait état depuis dix ans une écurie de 25 chevaux.

L'expérience avait été faite sur des lot témoins, ce qui a permis d'etablir qu'il suffit d'ajouter à la ration une quantité de 0·700 kilogramme de tourteau d'arachide pour des chevaux de 700 kilogrammes.

L'auteur croit qu'il est bon de donner environ par kilo et par jour 1 gramme de tourteau d'arachide.

[Translation.]

GROUND NUT CAKE IN THE DIET OF THE HORSE.

Fodder being very dear in Paris, the author has attempted to substitute for it a different feeding stuff.

He has utilized for this purpose straw, peat mixed with molasses, and ground nut cake. He thus obtains a feeding stuff containing the same elements as hay, and has been able to maintain in perfect condition for ten years a stable of 25 horses.

The experiment, which was made on test groups, has enabled it to be established that an addition to the ration of 0·700 kilograms of ground nut cake is sufficient for horses of 700 kilograms.

The author believes that good results are obtained by giving about 1 gram of ground nut cake per kilogram per day.

LE RAZZE OVINE DELLA TRIPOLITANIA E LORO POSSIBILE MIGLIORAMENTO PER LA PRODUZIONE DELLA LANA.

Per Dott Alberto Caselli.

[Abstract.]

La breve nota presentata dal dott. Alberto Caselli dell' Istituto Agricolo Coloniale Italiano, si riferisce allo studio delle razze ovine della Tripolitania che hanno maggior attitudine alla produzione della lana e all'analisi di numerosi campioni di lana provenienti da diverse regioni della Tripolitania e appartenenti a soggetti di differente sesso e di diversa età.

I notevoli difetti riscontrati nei caratteri dei singoli fili riguardo allo spessore, elasticità, ondulazione e resistenza, rendono giustificato il piccolo valore che la lana Tripolitania ha sui mercati Europei. E nell'esaminare i criteri generali che si seguono nella selezione e nella trasformazione dei tipi scadenti, il dott. Caselli fa alcune considerazioni sui resultati ottenuti dagli esperimenti eseguiti per il miglioramento della produzione ovina in alcuni paesi dell'Africa Settentrionale, ed espone infine un piano concreto sui sistemi e sui mezzi pratici atti a conseguire un miglioramento della produzione ovina della Tripolitania.

[Translation.]

BREEDS OF SHEEP IN TRIPOLI AND THEIR POSSIBLE IMPROVEMENT FOR THE PRODUCTION OF WOOL.

The short memorandum submitted by Dr. Alberto Caselli, of the Italian Colonial Agricultural Institute, refers to the study of those breeds of sheep in Tripoli which are most suitable for the production of wool, and to the analysis of the numerous samples of wool obtained from the various regions of Tripoli and from animals of different sexes and ages.

The noteworthy defects found in the constitution of the single threads as regards thickness, elasticity, undulations, and strength justify the low value which Tripoli wool has on the European market. Dr. Caselli examines the general criteria followed in selection experiments and in improving inferior varieties, and makes some observations with respect to the results obtained from experiments carried out for the improvement of sheep breeding in some countries of North Africa. He finally submits a definite scheme with respect to the methods and practical means suitable for obtaining an improvement in the breeding of sheep in Tripoli.

PECORE E CAPRE DELLA TRIPOLITANIA.

Per Professore Carlo Pucci.

[Abstract.]

Le pecore e le capre sono le specie animali più diffusamente allevate in Tripolitania. L'autore espone estese notizie intorno ai caratteri morfologici e fisiologici delle une e delle altre. Rileva l'importanza etnica e fisiologica del lipoma caudale delle pecore; a queste spetta il primo posto come produttrici di carne, tenuto conto anche della loro mirabile attitudine ad accumulare rapidamente carne e grasso nei periodi di pascolo verde.

Nè minor valore esse hanno per la loro produzione di lana. Il relatore riassume dati numerosi intorno al reddito in lana greggia e lavata di maschi e di femmine ed intorno alla qualità del vello.

Afferma inoltre che la capra è un elemento indispensabile alla vita pastorale degli indigeni, rappresentando essa nella Tripolitania la macchina animale più adatta alla produzione del latte. E dopo avere accennato le condizioni di pascolo e di clima della nuova colonia italiana, l'autore conclude che le pecore e le capre—data la loro grande adattabilità e la loro speciale resistenza alle vicissitudini del clima ed alle necessità della transumanza—debbano essere ritenuti gli animali idonei alla messa in valore delle steppe della Tripolitania.

[Translation.]

THE SHEEP AND GOATS OF TRIPOLI.

Sheep and goats are the kinds of animals most extensively bred in Tripoli. The writer gives ample information respecting the morphological and physiological characteristics of both kinds and points out the racial and physiological importance of the caudal lipoma of the sheep.

Sheep take first place as producers of meat, owing to their admirable aptitude for rapidly accumulating flesh and fat during the periods of grazing. Their value with reference to the production of wool is not in any way less.

The writer summarizes numerous data respecting the yield of wool in the yolk and of washed wool of males and females and the quality of the fleece.

He asserts, moreover, that the goat is indispensable to the pastoral life of the natives, and that in Tripoli it represents the

animal best adapted for the production of milk. After referring to the conditions of pasturage and of climate of the new Italian Colony, the writer comes to the conclusion that sheep and goats, in view of their great adaptability and their special resisting powers in regard to changes of climate when moved to different pasture grounds, must be considered as the most suitable animals for profitably working the steppes of Tripoli.

ZOOTECHNICAL EXPERIMENTS IN THE BELGIAN CONGO.

By M. Van Damme,

Colonial Office, Brussels.

[Abstract.]

All the races of native domestic animals in the Congo are susceptible of improvement. The cattle give a very small amount of milk, and their yield of meat is not considerable. The goats do not give much milk. Fowls are very small.

On the other hand, certain species of useful animals, such as asses and horses, do not exist in the Belgian Congo, and the possibility of breeding them has still to be experimentally shown. With the object of studying these questions the Government has founded several experimental breeding-stations and has imported into the Colony animals of different foreign breeds. The zootechnical researches actually being made concern cattle, buffaloes, horses, asses, pigs, goats, and poultry.

(1) Cattle.

(*a*) *Belgian-bred Cattle.*—Belgian bulls have been imported and crossed with native cattle. The cross-bred animals are far superior to the local breed so far as concerns their conformation and the development of their milking qualities.

(*b*) *Brittany Cattle.*—A herd of small Brittany milch cows are being tried for milk production at the experimental station of Zambi (Lower Congo). The results so far are very satisfactory.

(*c*) *Dahomey Cattle.*—A small herd of the small Dahomey cattle has been tried for breeding purposes in the Lower Congo bush at Zambi. They are very hardy and seem to do very well in their new home.

(*d*) *Indian Zebu Cattle.*—A dozen Zebu cattle of the Nellore breed, bought in India, have been acclimatized in the Congo

(Zambi station) without the least difficulty. Their reproduction is normal, and the breeding is done with the greatest ease.

(2) Buffaloes.

Twelve Italian buffaloes were imported in 1911 into Lower Congo, and arrived in the best condition, but eleven of them died a month afterwards. Their death was attributed to *barbone*. The twelfth animal, a young cow, is still in perfect health.

(3) Horses.

(*a*) *Senegal Ponies*.—The M'Bayar of Cayor breed of ponies, imported from Senegal, have kept in good condition in the Congo, where they breed normally.

(*b*) *Sandalwood Ponies*.—Some ponies of the Sandalwood breed have just been imported from Java into Lower Congo for breeding purposes. They are kept at Zambi, and seem to thrive.

(*c*) *Belgian Horses*.—Some Belgian-bred mares of the Ardenne type have been sent to the Lower Congo experimental station on trial for the breeding of mules. Some young mules have been born from these mares and are very strong and tall. The Belgian horse is, however, too heavy for this country, the soil not being sufficiently fertile to provide sufficient food.

(*d*) *Russian Horses*.—Russian saddle-mares have become acclimatized in the Belgian Congo; they are very hardy, and breed normally.

(4) Asses.

(*a*) *Senegal Asses*.—The small grey Senegal ass has been easily acclimatized in the Congo, and breeds normally.

(*b*) *European Asses*.—French Poitou and Italian asses are also being tried for breeding purposes on four experimental stations in the Belgian Congo. They took longer to get used to the climatic conditions than the Senegal asses, but they are now getting on very well.

(5) Pigs.

Belgian Pigs have become acclimatized in the Congo, and breed normally.

(6) Goats.

White Flemish Milk Goats imported into Lower Congo proved very difficult to keep in good health as they do not stand the heat well.

(7) Fowls.

The Belgian "Coucou de Malines" breed of fowls (Brussels Chicken) do well in the Congo and give good results when crossed with native hens. The cross-bred chicks are large and quite good in every respect.

LES MULETS A COURTE-FACE DE L'AFRIQUE.

Par Professeur P. Dechambre,

Professeur de Zootechnie aux Ecoles nationales d'Alfort et de Grignon.

[No abstract supplied by the author.]

DE L'UTILISATION DES MOULINS A VENT AUX COLONIES.

Par H. Pillaud.

[No abstract supplied by the author.]

NOTES ON STEAM STUMP-PULLERS AND PLOUGHS AS USED IN KATANGA, BELGIAN CONGO.

By Civil Engineer Mullie,

Colonial Office, Brussels.

[Abstract.]

The whole of the copper-mining district of Katanga being covered by forest, full of tsetse fly, and very sparsely populated, the clearing and the first ploughing of the valleys or dembos has to be done by steam. The transportation of goods is done by steam tractors and steam or motor wagons, with light motor cars on a few roads. Carriers are still largely used.

The note describes the special features that should be found in engines that are to work in Katanga or similar countries. The author stayed for several months in Katanga, and keeps in touch with the mechanics and engineers who work the engines around Elisabethville, so that his remarks are founded on actual experience and may prove of value for other colonies intending to apply steam power to the clearing of agricultural land.

IL R. GIARDINO COLONIALE DI PALERMO E LA SUA ATTIVITA.

Per Professore A. Borzì,
Direttore del R. Giardino Coloniale, Palermo.

[Abstract.]

Fino dal 1906 si istituiva, annessa all'Orto Botanico di Palermo una " Sezione Coloniale," oggi trasformata con legge dello Stato in R. Giardino Coloniale, rivestendosi di forma ufficiale quella fertile attività che l'Orto palermitano aveva, si può dire, iniziato fin dalla sua fondazione e che è andato vieppiù intensificando in questi ultimi tempi.

La lenta trasformazione nelle direttive di questo Istituto è, del resto, frutto delle speciali condizioni di clima della Sicilia, che, stendendo le sue spiaggie verso i lidi africani, rannoda con passaggi insensibili, le terre desertiche tropicali ai continenti europei. Queste speciali caratteristiche hanno determinato in coloro che sono stati preposti allo Direzione del Giardino di Palermo, quelle tendenze allo studio di piante esotiche, quei tentativi, il più delle volte felici, di acclimatazione, quegli studi sui miglioramenti delle specie introdotte o di quelle indigene, che hanno assorbito gran parte dell' attività dei Direttori e dei loro coadiutori; trasformazione del resto rispondente alle nuove direttive degli Istituti di Botanica.

Quando l'Italia non possedeva nè la Libia, nè la Somalia, nè l'Eritrea, il clima di Palermo aveva già dato alla Sicilia gli agrumi, ricchezza oggi inestimabile; aveva già spinto ad iniziare studi su le più importanti varietà di cotone, di banani, anona, ecc. D'allora in poi gli studi di acclimatazione ebbero una maggiore estensione e furono diretti alle più svariate piante di interesse agricolo-economico-sociale. Di qui tutta quella mole di lavori di cui fanno testimonianza le numerose pubblicazioni e memorie inserite nei Bullettini dell'Orto Botanico e Giardino Coloniale di Palermo.

Ma mentre fino al 1906 gli studi di acclimatazione avevano, salvo qualche eccezione, carattere di ricerca scientifica; dopo questo periodo assunsero quegli scopi speculativi, per cui, dal campo delle ricerche di gabinetto, si stabilirono i dati fondamentali economici per ciascuna delle colture sperimentate. E così, per i risultati positivi, cominciarono i primi campi dimostrativi, dei quali, quelli relativi ai cotoni, assunsero tale uno sviluppo da estendersi in tutta l'Isola.

Era il lavoro di propaganda fatta di viva voce, onde introdurre piantagioni rispondenti ai bisogni della terra, del clima, e del mercato.

Naturalmente la scelta delle specie da sperimentare per ragioni facili ad intendersi procurò una sinonimia fra piante esotiche e piante coloniali, tanto più se si considera che come la Sicilia rappresenta l'anello di congiunzione dell'Italia con l'Africa, il Giardino Coloniale esprime nei suoi studi, nel suo indirizzo l'anello che congiunge entrambe le flore, allacciando l'agricoltura coloniale a quella nostrale.

I quesiti ai quali il Giardino ha rivolto fondamentalmente la sua attenzione si riassumono:—

1°. Ricerca di foraggere estive.

2°. Utilizzazione dei terreni aridi.

3°. Introduzione di colture industriali.

Le prime intese a promuovere l'allevamento del bestiame e la conseguente produzione di stallatico, le seconde miranti ad utilizzare tante estese plaghe dove la roccia affiorante rende impossibile qualunque delle comuni coltivazioni, le ultime tendenti ad introdurre nell'Isola tutte quelle industrie che dipendono da produzioni vegetali.

Rispondendo a questi tre quesiti Giardino Coloniale di Palermo non ha trascurato di rivolgere la sua attenzione ad altre questioni di indole generale, come il rinsaldamento delle dune, delle sabbie mobili, la utilizzazione delle arene marine, ecc., tenendo sempre di mira i bisogni del commercio e rapportandoli alle condizioni agronomiche dell'isola.

[Translation.]

THE ROYAL COLONIAL GARDEN OF PALERMO AND ITS WORK.

As far back as 1906 there was established, in connection with the Botanical Garden, a "Colonial Section" which is now transformed by the law of the State into the Royal Colonial Garden. This has taken up officially the fruitful work which the Palermo Botanical Garden had previously initiated, we might say from the time of its foundation, and which has been developing steadily during more recent times.

The gradual transformation in the guiding principles of this institution is, moreover, the outcome of the special climatic conditions of Sicily, which, spreading out its shores towards the African Continent, connects, by a hardly perceptible transition, the desert and tropical lands with the European Continent. These special characteristic features inclined those who have been placed at the head of the administration of the Palermo Garden to devote themselves to studies of exotic plants, acclimatization experiments (which mostly turned out successful) and investigations respecting improvements in

imported and native species, all of which have absorbed a great portion of the activity of the Directors and their assistants; this transformation is, moreover, in accordance with the modern policy of Botanical Institutes.

Before Italy possessed Libya or Somaliland or Eritrea, the Palermo climate had already presented Sicily with the orange and lemon, themselves an inestimable source of wealth. It has already given the impetus to studies of the most important varieties of cotton, bananas, pineapples, etc. Subsequently the studies of acclimatization underwent a further development, and were directed to the most varied plants having an agricultural, economic, and social interest. From this arose an immense volume of work evidenced by the numerous publications and notices inserted in the Bulletins of the Botanical Garden and the Colonial Garden of Palermo.

Up to the year 1906 the studies of acclimatization possessed, with a few exceptions only, the character of scientific investigations. After that time they were directed to those speculative purposes which made it incumbent to establish, from the experimental field, the fundamental economical data for each of the crops experimented with. In this way, and in consequence of the positive results obtained, the first demonstration fields were started, of which those relating to cotton assumed a development extending all over the island.

This was the work of propaganda, carried on by word of mouth, for introducing crops which answered the requirements of the land, the climate, and the market.

Naturally the selection of the species to be experimented with brought about, for reasons easily understood, a synonymy between exotic and colonial plants, the more so if it is considered that, in the same way as Sicily represents the link between Italy and Africa, the Colonial Garden forms in its studies and in its aims the link between the flora of the two countries connecting colonial and home agriculture with each other.

The questions to which the Garden has chiefly directed its attention may be summarized as follows:—

1. Investigations of summer forage plants.
2. Utilization of arid lands.
3. Introduction of industrial crops.

The first is intended to promote the raising of cattle and the consequent production of manure, the second aims at the utilization of extensive strips of shore where the outcropping rock makes any of the ordinary crops impossible, and the last tends to introduce to the island industries which depend on vegetable products.

In dealing with these three questions, the Colonial Garden of

Palermo did not omit to direct its attention to other questions of a general character, such as the consolidation of the dunes of shifting sand, the utilization of sea sand, etc., always with a view to the requirements of commerce and in connection with the agricultural conditions of the island.

INTORNO ALLA FLORA DELLA SOMALIA ITALIANA MERIDIONALE.

Per Professore Guido Paoli.

[Abstract.]

Nella Somalia Italiana Meridionale mancano del tutto le formazioni desertiche; la flora di tipo igrofilo è limitata alle foreste a galleria lungo il Giuba e meno sulle rive dell'Uebi Scebeli, negli stagni che costeggiano il basso Giuba, nella regione dei Balli ove si perdono le acque dell'Uebi Scebeli e nella formazione a mangrovie della foce del Giuba e di altri punti della costa.

Tutto il rimanente del Paese è occupato da flora xerofitica che si può dividere in diverse zone, come segue, tenendo conto specialmente della natura del suolo:—

1°. Zona delle dune fisse lungo tutta la costa per una profondità media di 15-20 km. con predominio di acacie basse e ad ombrella.

2°. Pianura di alluvioni del Giuba e dello Scebeli con predominio di prateria costituita da graminacee basse con pochissime leguminose; nelle località più umide, come lungo il Giuba, predominano invece le graminacee alte da 1 a 3 metri; talvolta la prateria bassa si trasforma in associazione a parco con la presenza di alberi distanti fra loro, per lo più acacia e terminalia.

3°. Terreni di origine calcarea, ancora più interni, rocciosi ed eluviali con boscaglia folta, prettamente xerofila con pochissime piante erbacee.

4°. Terreno sabbiosi silicei di origine granitica intramezzati coi precedenti nella parte più bassa; in questi la flora ha caratteri assai meno xerofili e gli alberi meno folti ricordano la formazione a parco. La vegetazione erbacea è rappresentata principalmente da graminacee, ciperacee e leguminose.

5°. Zona dei gessi, più interna ancora, con flora xerofila come nei terreni calcarei, con presenza di piante gipsofile e alofile.

Le coltivazioni indigene sono soprattutto nelle zone alluvionali lungo i fiume e in altre alluvioni interne come nel Baidoa.

[Translation.]

ON THE FLORA OF SOUTHERN ITALIAN SOMALILAND.

In Southern Italian Somaliland, desert formations are altogether wanting. The flora of the hygrophilous type is limited to the forests along the Juba and less on the banks of the Uebi Scebeli, in the swamps along the borders of the Lower Juba, in the region of Balli, where the waters of the Uebi Scebeli disperse themselves, and in the mangrove formation at the mouth of the Juba and at other points of the coast.

The remainder of the country is occupied by xerophilous flora, which may be divided into several zones as hereafter shown, taking into account, especially, the nature of the soil.

1. Zone of the permanent dunes along the entire coast, of an average width of from 15 to 20 kilometres, with low acacias and umbelliferous plants predominating.

2. Alluvial plain of the Juba and of the Scebeli, with a predominance of prairies constituted by low graminaceæ with very few leguminous plants between; in the damper localities, as, for instance, along the Juba, the graminaceous plants of from one to three metres in height predominate; sometimes the low prairie transforms itself into park-land with trees standing at considerable distances from each other, mostly acacias and terminalias.

3. Lands of calcareous origin still farther towards the interior, rocky and alluvial, with dense woods purely xerophilous and showing very few herbaceous plants.

4. Sandy and siliceous land of granitic origin, intermixed with the preceding formations in the lower parts; here the flora is of a less xerophilous nature and the other less densely grown parts recall to mind a park formation; the herbaceous vegetation is chiefly represented by graminaceous, cyperaceous, and leguminous plants.

5. Chalk zone, still farther towards the interior, with a xerophilous flora, as in the calcareous lands, with gypsophilous and alophilous plants.

The native plantations are chiefly in the alluvial districts along the rivers, or in the interior, as, for instance, at Baidoa.

SUR L'EXPLORATION DE LA FLORE DE L'ASIE RUSSE.

Par Boris de Fedtschenko,

Principal Botanist, Imperial Botanic Garden of Peter the Great, St. Petersburg.

[No abstract supplied by the author.]

PUBLICATIONS DEVOTED TO TROPICAL AGRICULTURE AND RESEARCH.

By W. R. Dunlop,

Scientific Assistant to the Imperial Department of Agriculture for the West Indies.

[Abstract.]

The number of journals, official and unofficial, dealing with tropical agriculture is large, and is still increasing. The writer is of the opinion that there is need for centralization; that the literature belonging to any group of colonies should be issued as far as possible through a central office, and a clear line drawn between literature which is local and that which is general in its application.

Another requirement is greater specialization, particularly in respect of papers on applied chemistry, biology, etc., which should only appear in journals devoted to these branches of science, and not in purely agricultural or commercial journals. Amendment in this respect would simplify reference work, and would give each kind of information its proper status.

The writer gives the three principal sources from which literature on tropical agriculture originates, and calls special attention to the importance of the summarizing publications, which are of great value owing to the scattered nature of information on the numberless subjects which come within the sphere of tropical planting and research.

The greater portion of the paper is devoted to an enumeration of those periodicals which deal especially with the various tropical crops of major importance. These notes appear under crop headings, viz., rubber, cotton and fibres, sugar, tea and rice, coffee and tobacco, coconuts and bananas, cacao and citrus fruits. The final section of the paper includes a list of the principal publications devoted essentially to plant pests and diseases.

AGRICULTURAL SANITATION IN THE GOLD COAST.

By W. H. Patterson,

Government Entomologist, Gold Coast Colony.

[No abstract supplied by the author.]

TUESDAY, JUNE 30.—AFTERNOON SESSION,

2.30 P.M.

Final General Meeting.

Chairman: The PRESIDENT.

THE names of certain official delegates appointed since the Congress opened were announced by the President.

The PRESIDENT: I now come to the resolutions passed at ordinary meetings of the Congress, and which need to be reported to you. The first is:—

> "That a Committee of this Congress be appointed to collect information as to the organization, actual work and cost (including salaries paid to officers) in connection with Government Departments of Agriculture in each tropical country."

The second resolution is:—

> "That this Congress should appoint a Committee to consider the whole question of sanitation and hygiene on tropical estates, and to report either to the next Congress or previously if possible."

The third resolution is:—

> "That arrangements be made for the interchange of publications between the members of the International Association for Tropical Agriculture."

The fourth resolution is:—

> "That a Committee be appointed by this Congress with instructions to see that the subject of agricultural co-operation (including credit) is given a prominent place at the next Congress, and to obtain reports from every tropical country where the subject is being considered and is the basis of action by Governmental authorities or voluntary agencies."

These four resolutions were approved and adopted unanimously by the Congress.

The PRESIDENT: I have to propose, as President of the Congress, three formal resolutions which I am sure will be acceptable to everyone. The first is:—

> "That the Delegates and Members of the Third International Congress of Tropical Agriculture desire to record their high appreciation of the hospitality so generously provided by His Majesty's Government at the opening of the Congress. They also desire to convey their best thanks to Mr. Harcourt, Secretary of State for the Colonies, and to Lord Emmott, Under-Secretary of State for the Colonies, for their personal interest and assistance."

The second is:—

> "That this Congress desires to record its thanks to His Grace the Duke of Bedford for his courtesy in inviting a party of Delegates and Members to visit his Experimental Fruit Farm at Ridgmont on June 27, 1914, and to Mr. Spencer Pickering, the Director of the Farm, for his kindness in conducting the party and explaining the work of the farm and the experiments carried out on it."

The third is:—

> "That this Congress desires to record its thanks to the Trustees of the Lawes Agricultural Trust for their courtesy in inviting a party of Delegates and Members to visit the Experimental Station at Rothamsted on June 27, 1914, and to Dr. E. J. Russell for his kindness in conducting the party over the Laboratories and the Station and describing the nature of the work carried on. Also to the Director of the Royal Botanic Gardens, Kew, for his courtesy in arranging for the visit of a party of Delegates and Members to Kew Gardens on the afternoon of June 27, 1914."

These resolutions were in turn put to the meeting and carried unanimously.

The PRESIDENT: Now we come to subjects on which motions have been brought forward by members of the Congress for consideration at this meeting. The first motion deals with the proposed establishment of an Imperial College of Agriculture in the British tropics. I personally need say little or nothing on the subject, because it formed an

important part of my opening address. I am very strongly in favour of the establishment of such a College, but I would invite remarks on the subject from any members of the Congress.

Sir HENRY BLAKE, G.C.M.G. (formerly Governor of Jamaica and Ceylon): Mr. President and Gentlemen—The resolution I have to propose is:—

> "That this Congress desires to support the proposed establishment of an Imperial College of Agriculture in the British tropics, and desires that a Committee of the Congress be appointed to take steps to co-operate with the London Committee which is promoting its establishment."

I take it that the reason why this resolution should have been confided to me is that I have had some experience in the tropics of both hemispheres. In Jamaica and in Ceylon I had the honour and pleasure of establishing agricultural associations for the express purpose of assisting tropical agriculture. It is perfectly clear that there ought to be a college of tropical agriculture, so conducted that the students will have the best opportunity, not only of receiving oral instruction, but also of examining the practical side of tropical agriculture in as wide a fashion as possible. That means that the College ought to be in a position where the students can study practically the greatest possible diversity of tropical crops under the most varying conditions available. I think that with those conditions a central college of agriculture will be of very great importance, not only to the British Empire, but to all the colonizing nations. Now, gentlemen, I think there will be no dissentients to the proposition that such a college of tropical agriculture is necessary, and I will say no more, but propose to you the resolution I have just read, and hope that it will be carried unanimously.

Colonel Sir HENRY MCCALLUM, G.C.M.G. (lately Governor of Ceylon): Mr. President and Gentlemen—I come to this Congress at the very last moment, having, unfortunately under medical advice, been unable to attend its proceedings. However, I am extremely glad to be here on this occasion to second the resolution which has been proposed to you in such excellent terms by my predecessor, Sir Henry Blake. He has pointed out the importance of an imperial college such as is referred to in the resolution. I must congratulate my friend, Professor Dunstan, on the very able way in which, in his opening address, he has brought this important subject to the notice of the Congress. He has done it in such excellent terms and so

clearly that I am sure it must have appealed to you all. After a very prolonged residence in the tropical colonies I cannot help feeling—and it has been brought home to me very closely in connection with my last governorship of Ceylon—how important it is that young men on estates, and the Government officials who are to give general instruction in tropical agricultural matters, should not be allowed to, if I may use the word, "drift" for their education as much as they have in the past. Young fellows have been put in as managers of estates without being able to get first practical knowledge of tropical agriculture, which is more important than I can possibly explain on this platform. Practical knowledge in tropical agriculture is one of those things by means of which we may probably be able so to improve and cheapen agricultural production as to be able to make a stand against the synthetic products which threaten us in many directions. The great point nowadays is that tropical crops should be produced as cheaply as possible, and this cannot be done unless there is perfect knowledge brought into play upon the estates. Greater cheapness would be, I believe, the means of a great extension of the use of these tropical products, and I feel, therefore, that the resolution which has been proposed for your acceptance to-day is a most important one, and I cannot but repeat after Sir Henry Blake that I hope, after all that has been written and said on the subject, it will receive the unanimous support of those present at this meeting.

The resolution was then put to the meeting by the President and carried unanimously.

The President: The next subject on the agenda is a motion with reference to the prevention of the introduction of plant diseases and pests into tropical countries. It was discussed at a meeting last week, but no resolution was arrived at. I understand that some of those who can speak with authority on this particular subject desire now to make some remarks with the view of putting a proposal before the meeting. The main point which was discussed the other afternoon, I may say, was as to whether the provisions of the Phytopathological Convention proposed at Rome were applicable or not to tropical countries.

Mr. E. E. Green (late Government Entomologist, Ceylon): Mr. President and Gentlemen—The resolution which stands in my name reads as follows:—

> "That in view of the Convention proposed at the International Phytopathological Conference, held in Rome in February, 1914, this Congress is of opinion

> that it is desirable that an International Committee be appointed by this Congress to consider how far the proposals in question are applicable to tropical countries."

The resolution, which is of a non-committal nature, has been put forward principally as there is a general feeling amongst working entomologists that certain articles of the Convention appear to impose limitations that would be disadvantageous to countries with which we are concerned, and that other articles, more particularly Article IV, afford an opening for the unrestricted introduction of plants liable to introduce serious pests. It appears to me that the last item—" any crops grown on a large scale "—would, if I read it rightly, vitiate the whole basis of legislation. It would exempt the staple products of any country which it is desirable to protect. With these few words I should like to leave the resolution for the consideration of members, who are in a better position at the present moment to discuss its merits.

Dr. L. H. GOUGH, Ph.D. (Chief, Entomological Section, Ministry of Agriculture, Egypt): Mr. President and Gentlemen—In seconding the proposal, I wish to draw attention specially to Article X of the Convention, which requires that each country shall draw up a very short list of the pests against which it wants to be protected. Agricultural conditions do not permit of drawing up a short list of plant enemies against which one wants to make a stand. If I were asked what should be done, I should say that it would be best to draw up a list of the insects against which I do not wish to legislate, namely, the commonest pests of the country. Every other insect I would strictly bar. The conditions in temperate climates and in the tropics are very different. In the temperate countries the exchange of destructive insects has already taken place to a very great extent. In tropical countries the exchange is only just beginning, and at the present moment any new insect that gets introduced into a tropical country is likely to become a very serious pest. This seems to me to be one of the chief weaknesses of the Convention, and I think it would be advantageous if a committee of this Congress were to consider the question before it goes much further.

My remarks are made purely in my personal character as a scientist, and not as Government delegate, as I have not yet had a chance of discussing the matter with my superior officers.

Lieut.-Col. Sir DAVID PRAIN (Director, Royal Botanic Gardens, Kew): May I ask what the powers of this committee would be, to whom this committee would report, and what the object of passing such a resolution is?

The PRESIDENT: The committee would report to the International Association, and its report would be printed for circulation among the members of the Association. Or, if it is judged desirable, it would be made as a report for adoption at the next International Congress. The reason for making the inquiry, as I understand it, is that it is thought that some consideration should be given to the question of the applicability of this Convention to tropical countries very few of which were concerned in drafting it.

Sir DAVID PRAIN: Then it would be necessary, I presume, for a resolution to be submitted to the Government of this country, and probably at an early date, because, so far as I understand the position, it is this—the Convention has been arrived at by a properly constituted conference of delegates representing various countries invited to attend, and the conference, having come to the conclusions which are embodied in that Convention, have presented those conclusions to their various Governments in such form that the Governments concerned must either accept the Convention as a whole, or they must put it aside as a whole. Any suggestion such as is made in this resolution seems to indicate that it is possible that that Convention can be modified. I do not think that it is possible for the Convention to be modified. I simply wish to call the attention of the meeting to that point before a vote is taken.

The PRESIDENT: I do not think that consideration should affect our action, because in any case it is very desirable that it should be stated on good authority, if it is true, that the Convention, whether officially adopted or not, is not applicable to all tropical countries. This committee would not in any sense be an official committee; it would be a committee appointed by the Congress to add to our knowledge, and would not in any way conflict with any action that the Governments affected by the Convention might deem it desirable to take.

Sir DAVID PRAIN: Still, do you not think it a very good thing that the representatives of tropical agriculture should empower you, as President of the Congress, to transmit a copy of the resolution to the Government?

The PRESIDENT: When the report is made it will still have to be considered, and if approved, adopted by the International Association. It will then be a question whether it should be transmitted to the Governments concerned and also to the International Agricultural Institute at Rome. But I do not think it is necessary at this stage that the committee should be instructed to send its report in any particular direction. It is for this meeting to decide what shall be done with the resolution it is now asked to pass.

M. Brenier (Indo-China): As I understand it, this matter is of some urgency. Might it not perhaps be useful that Government representatives at this Congress should be invited to make known to their Governments the terms of this resolution? If the Governments are going to adopt the Convention without knowing there is any objection in scientific quarters to it perhaps the report will come too late, whereas if the Government representatives at this Congress immediately make known to their Governments what the resolution of the Congress is, we might be in time to influence any action that may be taken.

The President: That is a very useful suggestion; it will require an addition to the resolution as proposed and seconded.

This course having been agreed to by the proposer and seconder, the following addition was made to the motion:—

> "And that the official representatives attending the Congress should communicate this resolution to their Governments."

The resolution, thus modified, was put to the meeting by the President and carried unanimously.

The President: The next subject for consideration is the question of the desirability of proceeding to form a British Institute of Tropical Agriculture. This again is a subject to which I alluded very fully in my address as being in my view an urgent necessity at the present time, both in the interests of the subject and of those who are engaged in it.

Professor P. Carmody (Director of Agriculture, Trinidad): Mr. President—The matter has been very fully explained by yourself, and I think it is quite clearly understood by all the members of the Congress that it is desirable that such an institute should be formed. It is hardly necessary for me to remind you that there is not a single class of professional man—and even not always professional men—who are working at a subject for a common purpose, who have not banded themselves together into a society or institute of some kind for the purpose of advancing their interests. There are dozens—hundreds—of societies of the kind. The latest one that has been formed, and which is very nearly similar to our own, is the Institute of Petroleum Technologists. Recently the search for petroleum has necessitated the finding of workers in all parts of the world, and it has been very difficult indeed to find men with a sufficient knowledge of petroleum to be able to satisfy that industry. In consequence of that a school or college has been formed in this country for the purpose of teaching the mining of petroleum. And arising out of that

comes this proposal to form this Institute of Petroleum Technologists. The object is to acquire information and to disseminate it in connection with that particular industry. I think we want exactly the same action in connection with tropical agriculture. We are in a state of evolution; we are gradually advancing our knowledge of tropical agriculture in various directions, and many of us are working, and not knowing very clearly what other workers are doing. It seems to me desirable that we should have some centre where this information could be obtained and disseminated among that particular body. I hope, Sir, that the proposal will be generally accepted, because it seems to me to be a necessary step which must be taken sooner or later. I have much pleasure in proposing this resolution:—

> "That this Congress desires to afford every assistance to the formation of a British Institute of Tropical Agriculture, and empowers the Committee of the Congress to take the necessary action in the matter."

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): Mr. President and Gentlemen—I think there is very little for me to say. Professor Carmody put forward the views held by most men who are working in the tropics. We have found for a number of years—at this Congress especially we notice it—that men are attending the Congress who are working along the same lines as ourselves; and I, personally, as a worker in tropical agriculture would have welcomed very much the opportunity of meeting some of the men who are working on the same lines as myself during the last few years. If we had a British Institute of Tropical Agriculture there would be a possibility of our having meetings and gatherings together and exchanging views. In fact, on the whole question I can see nothing but arguments in its favour, so I do not think I need say anything further. I have pleasure in seconding the resolution.

M. E. Leplae (Belgium): Mr. President and Gentlemen—I only wish to say that if an Institute of Tropical Agriculture is established in London it will certainly be very useful for all nations that are interested in tropical agriculture; and, although we in Belgium have nothing to say in regard to what is done in England or the British Colonies, I ask liberty to express the great satisfaction my Government will have when it hears of this proposal.

Dr. O. Warburg (Germany): I can say that Germany will be very glad to hear that the British Empire will establish such an institute as has been proposed. Germany has begun already to have such a society as a section of our general agricultural society. That is sufficient for Germany, because our colonies

are neither large enough nor developed enough to have a separate society for this purpose, but for England I think it would be better to have a quite independent society concerned only with tropical agriculture.

In reply to a question from Dr. Heim, the President explained that the operations of the institute need not conflict in any way with those of the International Association for Tropical Agriculture.

The resolution was then put to the meeting by the President, and was carried unanimously.

The PRESIDENT : Sir James Wilson has given notice of a resolution which I will read :—

> "That this Congress requests the International Association for Tropical Agriculture (1) to take such steps as it may find necessary or expedient to ensure that the interests of tropical agriculture are given their proper share of attention by the International Institute of Agriculture at Rome, and more especially (2) to urge upon the Governments of countries lying wholly or partly within the tropics, which have not yet adhered to the International Institute of Agriculture, the desirability of their adhering without delay, in order to secure on that body a due representation of tropical agriculture."

I will call upon Sir James Wilson to speak to that resolution.

Sir JAMES WILSON : Mr. President and Gentlemen—In order to prevent misapprehension, may I explain in the first place that, although I have the honour of representing the British Empire on the Permanent Committee of the International Institute of Agriculture at Rome temporarily for the last few months, I am not deputed here as a delegate from that institute? That institute has made up its mind that it will not be represented by a delegate appointed by itself at any of these congresses, but they have asked me to report what goes on here which interests their work. I speak as a member of this Congress, interested as we all are in the advancement of tropical agriculture, and my special interest in that subject has been due to my long service in India.

Now if you look round the world and consider how we can best aid and encourage tropical agriculture we find established at Rome an International Agricultural Institute, which might, at all events, be made use of for the benefit of tropical agriculture. Perhaps you will let me explain to you somewhat at length what that institute is, as I think there is considerable misunderstanding about it. It is an international institute, and fifty-four Governments have adhered to the

convention under which it was founded. It is an official institute, managed by different officials appointed by the delegates of the different Governments, who sit there permanently and govern it. It is a wealthy institute, and has an income furnished by those Governments, in addition to the £12,000 a year which the King of Italy has most generously subscribed towards it. The total income this year is estimated at £47,000. The adhering states pay of that amount £35,000, and I may mention, parenthetically, that the states of the British Empire adhering to that institute pay of that sum about £3,900 a year, or about one-twelfth of the total. The states group themselves into five groups. Those in the first group pay £1,600 a year, and so on downwards, until we come to those in the fifth group who pay only £100 a year. Each of the states appoints a delegate to the permanent committee, so that the institute is governed by official delegates of all the adhering countries. There may have been a sort of impression that the institute is run more in the interests of temperate than of tropical regions. That perhaps is to be expected in a sense, because the temperate countries are more advanced in these matters, and the delegates coming from those countries are generally very experienced and intelligent men. But the institute by no means confines itself to the temperate regions. As a matter of fact, each of the tropical countries adhering is represented on the tropical committee, and perhaps, if I am not detaining you too long, you will let me read you a list of those tropical countries which subscribe to the institute and have representatives on the governing body. To begin with America: Cuba, Mexico, Guatemala, Salvador, Nicaragua, Costa Rica, Colombia, Venezuela, Ecuador, Peru, Chile, Argentina, Paraguay, Brazil. In Africa: Algeria, Tunis, Tripoli, Egypt, Abyssinia, Eritrea, Union of South Africa, Mauritius. In Asia: Turkey, Persia, India, China, Netherland Indies. Australia also is one of the adhering countries. So that you already have on the institute a number of representatives of tropical countries. Then if you look at our three bulletins published monthly you will find a good deal of information given with regard to tropical crops, including statistics, etc., relating to rice, sugar, cotton, tobacco, and maize collected from all the different countries of the world. In fact, these bulletins contain the most accurate and up-to-date information which could be put together by any body. Then in the technical and economic bulletins you will find frequent quotations from documents published by tropical countries and references to tropical interests. Now there is no doubt that the institute might pay more attention than it does to these subjects, and the best way in which to attain that end

is to get the tropical countries more largely represented on the permanent committee by getting the Governments of those countries to adhere to the convention, paying part of the cost, and appointing their representatives on the committee. Just let me tell you which are the tropical countries which have not yet adhered. In America, Jamaica and the other West Indian Islands belonging to different Governments with the exception of Cuba, the Panama Republic, the three Guianas, and Bolivia. All the rest of America has adhered. In Africa the non-adherents are all the colonies which belong to Britain, France, Germany, Belgium and Portugal. In Asia the non-adhering countries are French Indo-China, Siam, Ceylon, Borneo, the Philippines, and the many other islands belonging to different European Powers. There are, therefore, a number of tropical countries still which have not adhered, and if they would adhere and send delegates to the institute, no doubt the institute would be induced to pay more attention than it does to the interests of tropical agriculture. The British countries which do adhere are: Great Britain and Ireland, Canada, Australia, Union of South Africa, New Zealand, India and Mauritius.

Now it is possible, it seems to me, for a colony which wishes to be represented there either to adhere individually—there is no doubt about that being possible, as in the case of Mauritius—and paying at the least £100 a year towards the cost of the institute, or it is also possible for a number of colonies to group themselves as one state with reference to the institute, having one representative, and paying one subscription. For instance, the whole of the British Crown Colonies might, I think, combine and group themselves as a state with reference to the institute in the first class and pay £1,600 a year, distributing that £1,600 amongst themselves. That is a plan which might be considered by the British Crown Colonies, and also by the colonies of other powers which have a number of tropical possessions. This is an International Congress, and it is desirable that we should look at things internationally, and here in Rome you have this wealthy international body permanently at work, and I think we should try and secure their services more perfectly than at present is done for the purposes of tropical agriculture. I suggest that you cannot do better when you go home than try and persuade your Governments to take part in forming a group of colonies under the International Agricultural Institute at Rome.

Sir Sydney Olivier (Permanent Secretary to the Board of Agriculture): I should like to support that resolution in a very few words. I would like this Congress to take the matter into consideration in the same spirit in which the International

Congress of Agriculture has taken it. We have at Rome this strong institute, which is well endowed, and which is strong because of the great interest which various European Governments—much more so than the British Government—have taken in sending able men to that institute in order to promote the interests of agriculture all over the world, both in their dependencies and in their own countries. And I have no doubt myself whatever, from the part I have taken in the proceedings of that institute, that it is going on to be a stronger and more important institution than it is, both as a collecting house for information, which it disseminates through its three great bulletins, and also as a means of securing international understandings, conventions, and regulations with regard to agriculture, and bringing up the inspection, regulation, and sanitation of agriculture to a higher level all over the world than at present. It is a strong institute, a permanent institute, and an institute which I believe is going to play a great part in the future of the world. Now the International Congress of Agriculture which met last year at Ghent sent to the Agricultural Institute at Rome a recommendation that the members of the Rome Committee who specially represent the agricultural countries should pay special attention to them in the proceedings of the institute, and I think this Congress should do the same; it should associate itself with the International Agricultural Institute at Rome, and recognize that institute as a permanent workshop for international understandings and information, and should recommend its proceedings to that institute, so that any observations it may have to make, for instance, on the Phytopathological Convention, should go direct to that institute as from this Congress, and should also go to it as from the representatives of the various Governments represented on this Congress. The final acceptance of such a convention is to be decided by the Governments concerned, and they would not enter into any convention without consulting their tropical dependencies as to whether those dependencies should be involved or not. But what I wished to support in Sir James Wilson's speech was the importance of this Congress of Tropical Agriculture associating itself with the making use of the International Institute at Rome in the same way as the International Congress of Agriculture at Ghent has done. I have great pleasure in supporting the resolution.

Mr. H. Hamel Smith: Whilst I do not want in any way to go against the proposal, I would like to say, speaking purely as a layman in the matter, that things move so quickly in the tropics that I believe that any central body that has to do with the organization of action against pests would do better work

in London than at Rome. The International Agricultural Institute at Rome will certainly do great work, but when one has carefully studied the epidemics which are inclined to spring up in the tropics, and when you consider that this country has such an important area of tropical dependencies, I am rather afraid of committing myself to have to refer all these matters to Rome to wait until an international committee has handled them and agreed to them, and then, I suppose, sent them back to us to be administered and worked upon. If we can still keep to ourselves the right, so to speak, of taking matters in hand when we want to, then I am quite ready to have one central organization, but I cannot help feeling that I would rather have the organization that has to do the work in London than in Italy, and to have to come back to us after the matter has been discussed there.

Sir Sydney Olivier: Might I perhaps make an interpolation on Mr. Hamel Smith's point? No Government or association in any way sacrifices its autonomy by supporting this resolution; it only gets the benefit of the collaboration of other minds in the advancement of the interests of agriculture. The Government of the United States, the Government of England, or any foreign Government is not in the slightest degree hampered in its independent action in dealing with its own pest or pests by the action of the institute at Rome. The institute at Rome only furnishes a common clearing-house for such agreement as can be arrived at; and any decision of any Government is referred to the institute at Rome before being ratified. It is simply a common ground for the collection and diffusion of information, so that it does not appear to me that Mr. Hamel Smith's fears—and I have had a great deal of practical experience—are at all relevant to the position as it really exists.

Mr. R. N. Lyne (Director of Agriculture, Ceylon): I should like to say, as belonging to the Government of one tropical colony, that I should have liked to have seen a copy of these resolutions before being asked to vote on them, because, although one may not vote in favour of any particular resolution, nevertheless the fact of one being present at the meeting might be interpreted as being equivalent to supporting them, when the fact really is that one has not had an opportunity of fully considering what official responsibilities and obligations are concerned.

At the request of M. Boris de Fedtschenko (Russia), the President read again the terms of the resolution.

Professor P. Carmody (Director of Agriculture, Trinidad): I would have liked to have had this resolution of Sir James Wilson to read over before the meeting commenced, and

although you have expressed your opinion, Mr. President, that it is an extremely simple resolution, I should be obliged if you would allow me to read it again. I have the greatest admiration for this International Institute of Agriculture at Rome, and for the work it is doing, and I would wish very much to do what Sir James Wilson suggests—that is, when I go back to my own colony to urge upon the Government the desirability of their adhering without delay in order to secure upon that body a due representation of tropical agriculture. But the difficulties, Sir, are enormous. Take our own case. In the West Indies we are all separate Crown Colony Governments. Some could afford to pay a subscription of £100 a year; others could not do so, because they would ask themselves, "What is the advantage of our being represented on this International Institute at Rome, when the matters that are dealt with there are principally concerned with products cultivated in temperate climates?" Then again, Sir, supposing that in the case of Trinidad I succeeded in persuading the Government to subscribe £100, the next difficulty I would have would be this: I take it that the mere subscription without sending a qualified representative to attend the meetings would not be of any great benefit to my colony. I think, Sir, that it would be absolutely impossible for the Government of the Crown Colonies in the West Indies to spare their qualified agriculturists to attend the meetings at Rome. First of all as regards the time occupied; there are very few men, as Sir Sydney Olivier is aware, and as all those who have had experience in the West Indies are aware, there are very few men in the agricultural departments who can be spared to attend these conferences, and the expense of sending them has also to be considered. The colonies have small revenues, and the consequence is they have very seriously to consider any expenditure of this nature which does not produce a result which they consider satisfactory. They would very probably feel that they were giving a very nice holiday to one of their officials, and that he was enjoying himself thoroughly. Now, Sir, unless tropical agriculturists were sent to this institute at Rome, I do not think the agriculturists, extremely able men as they are in their own country, would have any knowledge that would be of any practical value in connection with tropical agriculture. I will give you an example. We introduced into Trinidad examinations in agriculture the questions in which were set from Cambridge. No child who had been brought up under tropical conditions could have answered some of the questions, and we were obliged to advise the examiner as to the kind of questions he should set. It would be very much

the same at Rome; unless tropical agriculturists were present and could advise the institute as to what tropical conditions are, I am afraid the assistance which the institute at Rome would render to the tropics would not be of that value which the Governments would expect. In the next place tropical agriculture when taken collectively is a very small matter. The whole field of agriculture is, of course, represented at Rome, and there are very much bigger interests there, and it will be some little time yet, I fear, before tropical agriculture assumes sufficient importance to hold its own against these other interests. I was glad to hear from Sir James Wilson that statistics were coming out in the bulletins on cocoa, sugar, maize, and so on, but I had not seen them. We have all been waiting for the time to come when our tropical productions would receive due attention, and I am very glad they are beginning to do so, but we have had a long time to wait. We have had statistics for wheat and other temperate productions published very exhaustively, and, of course, that has been of great benefit to those interested in those cultivations. But naturally it takes a long time for this information to filter through. Well, Sir, I see such very great difficulties in connection with this proposal, especially the second part of it, that I would not like to commit myself to vote for it. I am in sympathy with the direction in which Sir James Wilson wishes us to go, and I believe in some few years we shall go in that direction. Probably by that time the International Agricultural Institute at Rome may have a section devoted to tropical agriculture, dealing with it separately by experts in tropical agriculture; but at the present time it seems to me I could not support the resolution, and I would suggest, if it were acceptable to the meeting, that it should be submitted to our committee for consideration. At the present moment, Sir, I do not feel myself prepared to vote for or against it, and I propose that it should be submitted to a committee of our Association for consideration.

Mr. J. S. J. McCall (Director of Agriculture, Nyasaland): I have listened to Professor Carmody's remarks, and I must say I am in total agreement with him. As far as I have seen the publications from Rome, they have mostly dealt with temperate agriculture. The present statistics, I may say, with regard to tropical agriculture in many of our possessions are extremely vague, and even the protectorates themselves are unable to contribute statistics, so that I really think it is perhaps a little premature to attempt to publish statistics of tropical agricultural production.

The President: Perhaps it may satisfy Sir James Wilson

if a committee is appointed to take into consideration the co-operation in this matter of the International Association for Tropical Agriculture with the Institute at Rome. If so, Professor Carmody and he would come together.

Sir James Wilson: I should like to say a few words with regard to what Mr. Hamel Smith said, that it took a long time to get things sent to Rome and to get orders back. As Sir Sydney Olivier has explained, any Government does what it likes in its own executive capacity. The International Agricultural Institute only collects information and disseminates it all the world over. Then as regards the difficulty of having each colony represented on the institute, of course no one suggests that a little colony like Trinidad should send someone to represent it. As I suggested, a whole lot of colonies might combine together and have a joint representative. As a matter of fact the representative for France represents also some of the colonies of France, and so on. It is not necessary to have a separate representative at all either for each colony or each group of colonies. Then again, as regards giving information in the bulletins about tropical products, it is the case already that the institute does give as full statistics as it can about those particular tropical productions I have mentioned—tobacco, sugar, and so on, and it is giving information as regards other products as well. I would just like to add this—that although certain tropical countries have not adhered to it, the institute desires to be a world-wide institute, and to give the benefit of the information it collects to all countries, whether they adhere or not. Any expert from any colony, if he chooses to send information and contributions to the bulletins, may be assured that the institute will be very glad to receive any communication of that kind. I should also like to mention that the institute has a splendid library, the best library of information—books, magazines, and so on—connected with agriculture in the whole world. It is the best library to be found anywhere, and this library is at the disposal of any student in any particular subject. I am quite prepared, sir, to have this question referred to a committee, and if the Congress is agreeable to that course, I shall be glad to accept that addition to my proposed resolution.

M. E. Leplae (Belgium): This question is of an international character, and the delegates of the different countries have not had time to discuss it. The International Institute at Rome is a very active and useful body, but I do not believe it has had up to the present funds enough to enable it to work usefully in tropical agriculture. The question is, are the tropical countries to give these means to the International Institute at Rome? As Professor Carmody said, if you do not send a

man you will not have any benefit from the work of the institute. If you send a man and pay his expenses that will certainly cost £1,000 a year. Now the organization of tropical agriculture is quite young yet; we do not know exactly what we should do in this direction, and it would be much better to wait, say, a year or two more before we take any definite steps. If a tropical colony spends £1,000 per annum on the International Institute at Rome, it may prove difficult to get further funds for some other work that may be even more useful to it. I would propose therefore to wait and not to vote on this resolution now.

Professor Dr. Heim (France) and Professor Silva Telles (Portugal) supported the view expressed by M. Leplae.

The President: There appears to be a general feeling on the part of the foreign delegates that this matter should be fully considered by a committee before we express any opinion on it. I rather think Sir James Wilson is himself inclined to favour that view, and therefore the best plan would be to ask you to agree to request a committee of the Congress to take into consideration the question of the co-operation of the International Association with the International Agricultural Institute at Rome. If that expresses your wishes I will put it to the meeting in the following form:—

> "That a Committee of the Congress be appointed to take into consideration the question of co-operation with the International Institute of Agriculture in Rome."

This resolution was carried unanimously.

Dr. O. Warburg: M. Leplae and I are bringing forward the following resolution:—

> "That this Congress resolves to appoint an International Committee, composed of representatives of each European country concerned, to consider the constitution of the Association Scientifique Internationale d'Agronomie Coloniale et Tropicale, and to suggest such changes in the constitution as may be required to improve international co-operation between the various societies interested in tropical agriculture."

The reason why we are making this proposal is very simple. This Association is young, and its policy cannot be regarded as definitely settled. Every year brings new ideas and suggestions, and it is necessary from time to time that its constitution should be altered in order that the Association may cope with new developments. It is impossible for various obvious reasons to discuss these alterations in large meetings, and

it would be best to appoint a committee consisting of representatives of each European country to do this work. We suggest "each European country," not because we wish to exclude the non-European countries, but because so long as the chief object of our Association is to have Congresses, and as long as the Congresses are held in Europe, European nations have the chief interest in them. The next point we suggest is that such changes should be made in the constitution of the Association as may be required to improve international co-operation between the various societies interested in tropical agriculture. This brings out the point that it is the representatives of societies and of official bodies who chiefly constitute our Congresses and give them importance, and so we think it is very important to go into the question of how it is possible to secure international co-operation among these various societies interested in tropical agriculture.

The proposal was seconded by M. E. Leplae, and M. Emil Baillaud spoke in support of it.

The President: I do not know if any other member of the Congress wishes to speak to this resolution, which proposes that an International Committee should be appointed to consider any changes that might be desirable in the interests of the International Association in order to improve international co-operation between the various societies interested. This expression of opinion on the part of the Congress, of course, will have to be referred by this meeting to the assembly of the International Association for Tropical Agriculture which was supposed to meet half an hour ago, and which will have to hold its meeting some time to-day.

This resolution was then put to the meeting and carried.

President's Closing Remarks.

The President: Gentlemen—It has been the custom with our foreign colleagues that the President should deliver a final address at the conclusion of the Congress; in fact, pronounce what I suppose may be regarded as a funeral oration. I do not propose myself to follow that practice, partly because time will not permit, as we have still another meeting to hold this afternoon. I would, however, like to say that it has been a great gratification to the British members to see such a distinguished gathering of their foreign colleagues at this Congress. I think it may be said that the Congress has been a very great success, if success is measured first by the number and distinction of those who have taken part in it; secondly, if it is to be judged by the number and importance of the papers; and thirdly, by the number of speakers. In all these directions I think we have been most successful.

But no congress that I ever had anything to do with has been entirely satisfactory to those who have taken part in it, and those of us of British origin have perhaps a particular tendency to criticize all that we ourselves do and take part in. And if you will allow me to mention them, there are two problems which, it appears to me, will have to be considered before the Congress meets again. We shall have to consider how to get through our business in a week; we have had a very large number of papers, but my own feeling has been that the time for discussion has not been sufficiently long, and yet it was practically impossible to provide any more. Some of our Continental friends desire to make proposals with a view to improving this matter of discussion at the next meeting of the Congress. There is another aspect of our work which I personally feel is very important, but again, time is the difficulty; and that is the few opportunities one has had of personal intercourse with those one meets from abroad but rarely. Speaking for myself these opportunities have been too few, and I find that the smoking-room which was provided at the beginning of the Congress has not been so largely used as one could wish. The reason for that is that we have met from about ten o'clock in the morning till about six in the evening, and there has been but a very short interval for lunch, and a shorter interval (often encroached on) for tea, so that there has been very little opportunity for us to meet in other ways. That is a matter which we ought in some way or other to try to improve.

We have had the great pleasure of receiving a number of very distinguished authorities in tropical agriculture, and the Congress has been a very great pleasure to me and, I know, to all connected with it, and, so far from pronouncing a funeral oration, I already look forward to the time and place of the meeting of the next Congress. There seems to be a general opinion that it should meet within the next three years. Where it shall meet cannot at present, I think, be decided. Some of our Continental friends wish to make some suggestions with regard to that, but I do not think that we can to-day, even if time allowed, decide the time and place of our next meeting. But wherever it is, we will hope that the meeting will be, at least, as large and successful as the present Congress.

M. E. Leplae (Belgium): I have to say in the name of

my Government, and certainly of many of the foreign delegates to whom I have spoken, that we wish to congratulate most sincerely Professor Dunstan on the splendid success of this Congress. I noticed that there had been sent in about 132 papers, and these came from about fifty different countries. I believe that is an achievement that has not been accomplished before, and we all know it has been due mostly to the great activity and the good organization that we owe to Professor Dunstan, so that I beg to present him with our congratulations on his great success. Now this Congress shows that tropical agriculture is going forward very rapidly. The first International Congresses on these matters were very simple. They were what I should call baby congresses with some ten or fifteen papers. There were some in France, some in Belgium, some in Germany, and in other countries, too, but they were as a rule rather restricted. We can now say that our congresses are full grown, and we must see that their organization results in the greatest usefulness. I would propose this for the next Congress—first of all that all the papers should be printed before the Congress opens, and that we should all receive, say about a week before the Congress, three, four, five or six volumes containing the papers sent in. I beg to say that that is done by many congresses on the Continent, and it is quite useful and very convenient. Of course, nobody dreams of reading these four or five volumes, but everyone reads those papers which are of special interest to him, and when he goes to the Congress he is able to discuss these matters in a way that we have not been able to do at this Congress. Secondly, I would propose that the reading of papers should be suppressed. That does not mean to say that the papers presented here have not been very highly interesting. From the first day to the last—even this morning—we have heard papers of the utmost importance for all colonies, and I must say that the papers we heard this morning were even better than many of those we heard on other days. But, unfortunately, if you start reading papers at full length, it is quite impossible to get through the work of a congress where there are 130 papers. In order to do so we should have to sit up all night. Then it is very trying to hear an author read a long paper in which one personally has but little interest, especially if it is read in a language one does not understand. Therefore, I would propose that papers should be presented beforehand, and that members should only deliver a short abstract of the principal points in their paper. That is sufficient to start a discussion, and I believe there is as much or more to be learnt by discussion as by reading the paper itself. I would only give one illustration of that. Professor Carmody, of

Trinidad, has laid before us splendid data on various aspects of cocoa planting. If we had been able to examine this paper beforehand we would have had a very interesting discussion on that paper alone, not to speak of others. I hope that the next time Professor Carmody brings us one of these very important compilations, we will all be able to discuss it thoroughly.

If a great number of papers come in, it is not possible to discuss them all in the same section. A congress should be split up into a great number of different sections. For instance, those people who are interested in cotton could come together and discuss cotton for one, two, or three days. Those interested in cocoa could meet in another room and deal with cocoa for several days. In that manner also we should be able to get to know better our Colonial colleagues interested in our own subjects.

I would propose, too, that some new sections should be introduced in future congresses. It occurs to me that the three International Congresses so far held have dealt only with tropical cultivation and tropical crops. Now that is only one part of tropical agriculture. For instance, there is the raising of cattle—the animal industry—which is a most important matter. It would be much better that our Congress should consider everything that appertains to tropical agriculture. These are the principal propositions I have to make.

Dr. C. J. J. van Hall (Netherlands and Netherland East Indies): Mr. President—Now that this Congress is coming to a close, I am sure that we all feel it has been really a success, and at the same time we know that this success is largely due to you and your collaborators, your able secretaries, and to the many other gentlemen who have worked to make these days as instructive and at the same time as agreeable as possible. We highly appreciate the fact that several of your most prominent men have taken the chair, and have told us their views, sometimes in a few words, but always in instructive and interesting words. It is said sometimes that the use and importance of these congresses is not so much within the congress hall as outside; and I feel convinced that outside the hall the English people have tried to make us feel that we were also of great importance and of great usefulness. Most of us, as tropical men, have already had much opportunity of admiring and enjoying English hospitality in the colonies. I always remember in the West Indies the Departments of Agriculture displayed not only a scientific but also a very friendly hospitality, and now that we have been in the position of enjoying also that hospitality in England, I can assure you that we highly appreciate it. I

am speaking also on behalf of the delegates of Germany when I say that we appreciate very much what we have heard in this Congress, and what we have enjoyed outside this Congress. And I want to express to you all my good wishes for every success in your work on behalf of tropical agriculture.

Professeur Dr. HEIM (France): Il me sera permis comme Secrétaire perpétuel de l'Association Scientifique Internationale d'Agronomie Coloniale et Tropicale, et aussi dans ma qualité de Délégué du Gouvernement Français, de joindre mes remerciments à ceux de M. Leplae, au Gouvernement Britannique pour l'hospitalité qu'il a bien voulu nous réserver, au comité exécuteur anglais, d'avoir apporté une contribution magnifique aux problèmes de l'étude qui nous est si chère, contribution qui peut ȇtre considérée comme une mine inépuisable de documents, et ensuite à notre cher Président, le Professeur Dunstan, de la façon superbe dont il s'est acquitté de l'œuvre, dont les destinées lui sont confiés pour l'instant.

[*Translation.*]—As permanent Secretary of the International Scientific Association for Colonial and Tropical Agriculture, and also in my capacity of Delegate of the French Government, permit me to add my thanks to those of M. Leplae to the British Government for the hospitality which it has been so good as to extend to us, to the English Executive Committee for having made a magnificent contribution to the problems of the science which is so dear to us, a contribution which may be regarded as an inexhaustible mine of information, and also to our President, Professor Dunstan, for the superb way in which he has carried out the work, the arrangement of which was for this occasion entrusted to him.

Dr. O. MANETTI (Italy): A nome del Governo Italiano e della Sezione Italiana dell'Association Scientifique Internationale d'Agronomie Coloniale che qui rappresento, porgo auch'io all'illustre Presidente, Prof. Wyndham R. Dunstan, ed agli infaticabili e benemeriti Segretari Organizzatori del Congresso il mio saluto ed i miei ringraziamenti.

La maravigliosa organizzazione di questo Convegno Internazionale insieme alla cordiale ospitalità del popolo inglese rimarrà in me come ricordo indelebile per molti anni e come prova più vera della prosperità civile della grande nazione brittanica.

[*Translation.*]—In the name of the Italian Government and of the Italian Section of the International Association for Tropical Agriculture, of which I am here as the representative, I offer to our illustrious President, Professor Wyndham R. Dunstan, and to the indefatigable and excellent Secretaries of the Congress greetings and thanks.

The marvellous organization of this International Congress, together with the cordial hospitality offered by the English people, will remain indelibly fixed in my memory for many years and will stand as a sure proof of the prosperity of the great British nation.

Speeches of thanks and congratulations were also delivered by Professor Silva Telles (Portugal) and M. Boris de Fedtschenko (Russia).

The PRESIDENT: Gentlemen—Very briefly I wish to thank our friends from abroad for the very kind words they have used in appreciation of the success of the present Congress. There has been, as you may imagine, a good deal of work in connection with it, and a large part of the detail of that work has fallen upon the general secretaries, Dr. Henry and Mr. Brown, and also upon Mr. Bunbury, who has acted as our registration and hospitality secretary. I am quite sure that you will wish to pass, as indeed you have by acclamation, a very hearty vote of thanks to them for their very arduous labours.